JUL 20 1928

The Engineer.

Established 1856. Registered as a Newspaper.

OFFICE FOR ADVERTISEMENTS & PUBLICATION, 33, NORFOLK ST., STRAND, LONDON, W.C. 2.

VOL. CXLVI.—No. 3782] LONDON: FRIDAY EVENING, JULY 6, 1928 [PRICE ONE SHILLING BY INLAND POST 1s. 3d.

PUBLIC NOTICES

LIFT ENCLOSURE.

The Commissioners of His Majesty's Works, &c., are prepared to receive TENDERS before 11 a.m. on Tuesday, 24th July, 1928, for STEEL WORK LIFT FRAMING at the General Post Office (West), E.C.

Drawings, specification and a copy of the conditions and form of contract may be seen on application to, and bills of quantities and forms for Tender may be obtained from the CONTRACTS BRANCH, H.M. Office of Works, King Charles-street, London, S.W. 1, on payment of One Guinea. (Cheques payable to the Commissioners, H.M. Office of Works.) The sums so paid will be returned to those persons who send in Tenders in conformity with the conditions. 8973

Assistant Engineers (5) REQUIRED by the GOVERNMENT of the GOLD COAST for a tour of 12 to 18 months' service, with possible extension. Salary £480 a year for three years, then £510, rising to £920 a year by annual increments. Outfit allowance of £60 on first appointment. Free quarters and passages and liberal leave on full salary. Candidates, aged 25 to 35, must be Corporate Members of the Institution of Civil Engineers, or hold an Engineering Degree or Diploma recognised as granting exemption from Sections "A" and "B" of the A.M.I.C.E. examinations, or must hold the Testamur of the Institution of Municipal and County Engineers. Must be capable of taking complete charge of construction of buildings, bridges and roads, and have a thorough knowledge of surveying, quantities, and measuring up of work.—Apply at once by letter, stating age, qualifications and experience, to the CROWN AGENTS FOR THE COLONIES, 4, Millbank, London, S.W. 1, quoting M/6/8. 8950

The University of Sheffield.

SESSION 1928-29.

Vice-Chancellor: SIR HENRY HADOW, C.B.E., D.Mus., LL.D.

DEPARTMENTS OF MECHANICAL, ELECTRICAL, AND CIVIL ENGINEERING, METALLURGY, MINING, FUEL TECHNOLOGY, AND GLASS TECHNOLOGY.

The Courses in the above Departments extend over three or four years and prepare students to become specialists in one or other of these branches of Applied Science.

The LECTURE COURSES in all the Departments are supplemented by Practical Training in Laboratories and Workshops, which are fully equipped for the purpose of advanced scientific teaching, investigation and research.

Part-time Courses are arranged for students who desire to take special portions of any of the regular Courses.

In Mining Engineering and in certain of the Courses in Mechanical and Electrical Engineering, and in Glass Technology, arrangements are made to enable students who come to the University from works or collieries to take six months' Courses of study at the University and six months' practice at the works or colliery each year for a period of four years. During the first year such students should spend three terms at the University.

RESEARCH Fellowships and Scholarships are awarded annually.

The LECTURE COURSES commence OCTOBER 3rd, 1928.

The TECHNICAL LABORATORY COURSES commence SEPTEMBER 25th, 1928.

Particulars of Entrance and Research Scholarships available will be sent on application.

For further details of the Courses and for particulars of the Degrees, Associateships, Diplomas, and Certificates awarded on their successful completion, application should be made to

W. M. GIBBONS, Registrar.

8733

Hull Education Committee.

MUNICIPAL TECHNICAL COLLEGE.

PRINCIPAL: E. P. BATES, M.A.

WANTED, to commence 3rd September, a HEAD of the ENGINEERING DEPARTMENT.

Commencing salary £500 per annum, rising by annual increments of £20 to a maximum of £600 per annum.

Consultative work may be undertaken with the approval of this Committee.

Forms of application and further particulars may be obtained from the undersigned on receipt of a stamped addressed foolscap envelope, and must be returned so as to reach these offices not later than 11th July.

R. C. MOORE, Director of Education.

Education Offices, Guildhall, Hull. 23rd June, 1928. 8859

Northampton Polytechnic INSTITUTE,

ST. JOHN-STREET, LONDON, E.C. 1.

SCHOLARSHIPS IN ENGINEERING AND OPTICS.

An EXAMINATION will be held on JULY 18th and 19th at the Polytechnic for the award of the following Scholarships:—

THREE SCHOLARSHIPS IN ENGINEERING, value £18 per annum.

These Scholarships are tenable at courses extending over four years in Civil, Mechanical, Electrical or Aeronautical Engineering, and including ten months' practical experience in the works of large industrial firms.

ONE SCHOLARSHIP IN OPHTHALMIC OPTICS, value £18 per annum.

For further information apply to

S. C. LAWS, M.A., M.Sc., Principal.

8978

Northampton Polytechnic INSTITUTE,

ST. JOHN-STREET, LONDON, E.C. 1.

DAY COURSES IN ENGINEERING AND OPTICS.

An ENTRANCE EXAMINATION for admission in October, 1928, to Day Courses will be held at the Polytechnic on WEDNESDAY, JULY 18th, 1928.

Further particulars from

S. C. LAWS, M.A., M.Sc., Principal.

8979

The Engineer

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MANCHESTER MUNICIPAL COLLEGE OF TECHNOLOGY.

Principal:
B. MOUAT JONES, D.S.O., M.A. (Oxon).

UNIVERSITY OF MANCHESTER (FACULTY OF TECHNOLOGY).

DEGREE COURSES IN TECHNOLOGY.

The Prospectus gives particulars of the courses leading to the Manchester University Degrees (B.Sc. Tech., M.Sc. Tech., and Ph.D.) and Certificates in the Faculty of Technology in the following Departments:—

MECHANICAL ENGINEERING
(Prof. Dempster Smith, M.B.E., M.Sc. Tech., M.I.M.E.).
ELECTRICAL ENGINEERING
(Prof. Miles Walker, M.A., D.Sc., M.I.E.E.).
MUNICIPAL AND SANITARY ENGINEERING
(G. S. Coleman, D.Sc. Eng., A.M. Inst. C.E., A.M. Inst. M. and Cy. E., F.R. San. I.).
APPLIED CHEMISTRY, including General Chemical Technology, Chemistry of Textiles (Bleaching, Dyeing, Printing and Finishing), Paper Manufacture, Metallurgy and Assaying, Chemical Technology of Brewing, Electro-Chemistry, Photography, Colouring Matters, Foodstuffs and Fuels.
(Prof. James Kenner, D.Sc., Ph.D., F.R.S.).
TEXTILE TECHNOLOGY
(Prof. W. E. Morton, M.Sc. Tech.).
INDUSTRIAL ADMINISTRATION (Post-Graduate Course)
(J. A. Bowie, M.A., D.Litt.).

Prospectus will be forwarded free on application to the REGISTRAR, College of Technology, Manchester. 8929

University College of South WALES AND MONMOUTHSHIRE.
COLEG PRIFATHROFAOL DEHEUDIR CYMRU A MYNWY.

The Council of the College invites APPLICATIONS for the APPOINTMENT of ASSISTANT LECTURER and DEMONSTRATOR in ENGINEERING. The commencing salary will be £300 per annum.

Further particulars may be obtained from the undersigned, by whom three copies of application and testimonials must be received on or before July 16th, 1928.

D. J. A. BROWN, Registrar.

University College, Cardiff, June 20th, 1928. 8868

PUBLIC NOTICES

Sunderland Education Committee.

THE TECHNICAL COLLEGE.

DEPARTMENT OF MECHANICAL AND CIVIL ENGINEERING.

The Committee invite APPLICATIONS for the following POSITIONS:—

HEAD OF THE MECHANICAL AND CIVIL ENGINEERING DEPARTMENT.

Applicants must possess a First Class Honours Degree and have had good drawing-office experience and practice in marine engineering works.

The standard of the full-time day courses is that required for an Honours University Degree, and that of the part-time evening courses for senior and advanced students from the marine engineering drawing-offices and works of the district desiring Ordinary and Higher National Certificates of the Institution of Mechanical Engineers.

Present salary scale, £500-£50-£600 less 5 per cent. voluntary abatement.

LECTURER IN THE MECHANICAL AND CIVIL ENGINEERING DEPARTMENT.

Applicants must possess an Honours Degree in Engineering of a British University and have had a good practical training. Salary in accordance with the Burnham Award.

Application forms may be obtained from the Principal of the Technical College, Sunderland, and should be returned to the undersigned not later than Friday, 20th July, 1928.

HERBERT REED, Chief Education Officer.

Education Offices, 15, John-street, Sunderland, 3rd July, 1928. 8971

University of Liverpool.

FACULTY OF ENGINEERING.

DEAN: Professor C. O. BANNISTER, M.Eng., Assoc. R.S.M., F.I.C., M. Inst. M.M.

Prospectus and full particulars may be obtained on application to the Registrar of Courses designed for Students desiring to qualify as Mechanical, Electrical, Civil or Marine Engineers, as Naval Architects or as Metallurgists and Metallurgical Engineers. 8947

SITUATIONS OPEN

CHIEF ELECTRICAL ENGINEER WANTED for Collieries, Ironworks and Steel Works.—Address in the first instance, stating qualifications, salary required, &c., P4708, The Engineer Office. P4708 A

PUBLIC NOTICES

1928 E. No. 034

In the High Court of Justice
Chancery Division
Mr. Justice Astbury.
In the Matter of REES ROTURBO MANUFACTURING COMPANY LIMITED AND REDUCED
and
In the Matter of THE COMPANIES (CONSOLIDATION) ACT 1908.

Notice is Hereby Given that a Petition presented to the High Court of Justice, Chancery Division, on the 21st day of June 1928 for confirming the reduction of the capital of the above named Company from £250,000 to £112,561 by cancelling capital which has been lost or is unrepresented by available assets is directed to be heard before Mr. Justice Tomlin at the Royal Courts of Justice, Strand, London, on Tuesday the 24th day of July 1928.

Any creditor desiring to oppose the making of an Order for the reduction of the capital of the said Company under the above Act, may appear at the time of hearing by himself or his Counsel for that purpose. Such person is required to give two clear days' notice in writing of his intention to appear with the grounds of his objections to the undersigned Sharpe Pritchard and Co. the London Agents for the Solicitors of the Company.

A copy of the Petition will be furnished to any such person requiring the same by the undersigned Sharpe Pritchard and Co. on payment of the regulated charge for the same.

Dated the 29th day of June 1928.

SHARPE, PRITCHARD & CO.,
12, New-court, Carey-street, London, W.C. 2.
Agents for
UNDERHILL, NEVE, THORNEYCROFT, TAYLOR & CO., Wolverhampton,
Solicitors for the Company.
8949

Bengal-Nagpur Railway Company, LIMITED.

The Directors are prepared to receive TENDERS for:—

A.—2475 LAMINATED BEARING SPRINGS.
B.—TURRET LATHES.
C.—CRANK AXLE JOURNAL TURNING LATHE.
D.—COMBINED SURFACING, BORING, MILLING, DRILLING and TAPPING MACHINE.
E.—LOCOMOTIVE AXLE JOURNAL GRINDING MACHINE.
F.—PLANING and MOULDING MACHINES.
G.—SLOTTING MACHINES.
H.—LOCOMOTIVE OUTSIDE CRANK PIN GRINDING and QUARTERING MACHINE.
I.—PLANING MACHINES.
J.—GRINDING MACHINES.
K.—HIGH-POWER VERTICAL MILLING MACHINE.
L.—HEAVY GRINDING MACHINES.
M.—64in. CAPSTAN LATHES.
N.—MILLING MACHINES.
O.—90in. DOUBLE RAILWAY WHEEL LATHE.
P.—VERTICAL DRILLING MACHINES.
Q.—SLIDING, SURFACING and SCREW-CUTTING LATHES.

Specifications and forms of Tender can be obtained at the Company's Offices, 132, Gresham House, Old Broad-street, London, E.C. 2, on or after 2nd July, 1928.

A fee of 20s. will be charged for each copy of Specifications A and B, and of 10s. for each copy of Specifications C to Q inclusive, which is NOT returnable.

Tenders must be submitted not later than Noon on Monday, 16th July, 1928, for Specifications A, B, C and D;
Tuesday, 17th July, 1928, for Specifications E, F, G and H;
Wednesday, 18th July, 1928, for Specifications I, J, K and L;
Thursday, 19th July, 1928, for Specifications M, N, O, P and Q.

The Directors do not bind themselves to accept the lowest or any Tenders, and reserve to themselves the right of reducing or dividing the orders.

By Order of the Board,
R. C. VOLKERS, Secretary.
8956

Pontefract Corporation Waterworks.

NEW PUMPING MAIN.

The Corporation of Pontefract invite TENDERS from competent contractors for PROVIDING and LAYING 2000 YARDS of 16in. CAST IRON PUMPING MAIN from the site of the new Waterworks at Eggborough to the existing Roall Waterworks.

Copy of the specification and schedule of works may be obtained from the Consulting Engineer, Mr. F. Walter Hodson, M. Inst. C.E., M. Cons. E., of Bank Chambers, Loughborough, on deposit of cheque for £5 5s., which will be refunded on receipt of a bona fide Tender and the return of the documents. Copies of the drawings may also be seen at the office of Mr. W. H. Newton, A.M. Inst. C.E., Borough Engineer, Pontefract, and at the Roall Pumping Station.

Tenders are to be sent to the undersigned not later than first post 24th July, 1928.

F. M. FARMER, Town Clerk.

Municipal Offices, Pontefract, June, 1928. 8901

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PUBLIC NOTICES

State Electricity Commission
OF VICTORIA, AUSTRALIA,
22-32, William-street,
MELBOURNE,
AUSTRALIA.

TENDERS are HEREBY INVITED for the MANUFACTURE, TESTING, SUPPLY, DELIVERY and ERECTION COMPLETE for the Yallourn Power Scheme, of WATER-TUBE BOILERS with Auxiliary and Accessory Equipment, in accordance with Specification No. 28/37.

Copies of Tender form, specification, drawings, &c., will be available upon application to the Agent-General for Victoria, Victoria House, Melbourne-place, Strand, LONDON.

Charge £1 1s. for three copies of Tender form, conditions of tendering, specification, contract conditions and drawings complete. This charge is returnable under certain conditions as specified in the general conditions of tendering. Extra copies 10s. 6d. each, not returnable. A preliminary deposit of £100 shall be lodged with Tender.

Tenders on prescribed form, properly endorsed and addressed, must be delivered to the undersigned in Melbourne not later than 31st October, 1928.

The Commission does not bind itself to accept the lowest or any Tender.

B. LIDDELOW,
Secretary.
8825

The Abertillery and District
WATER BOARD.
SALE OF PLANT.

The above Board OFFER FOR SALE, a first-class ELECTRIC GENERATING PLANT, as under :—

No. 2 Ruston and Hornsby 230 B.H.P. TWIN-CYLINDER GAS ENGINES, with Producer Gas Plants complete.
No. 2 COMPOUND-WOUND GENERATORS, by Metropolitan-Vickers, 500-volt, 150-kW.
No. 1 Ruston and Hornsby STARTING COMPRESSOR.
No. 1 G.E.C. SWITCHBOARD.
No. 1 COOLING TOWER.

Also a smaller GENERATING PLANT, consisting of
No. 1 100 H.P. National GAS ENGINE and PRODUCER PLANT, with No. 1 Bruce Peebles 100-kW, 500-volt Dynamo.

Further particulars can be obtained from the Board's Engineer, Mr. J. Francis Jupp, M. Inst. C.E., Midland Bank Chambers, Newport, Mon. 8852

The Burma Railways Company,
LIMITED.

The Board of Directors of the Burma Railways Company, Ltd., are prepared to receive TENDERS for the SINKING of BRIDGE PIER FOUNDATIONS in the RIVER IRRAWADDY, at SAGAING, BURMA.

The work comprises the Assembling and Riveting of Steel Well Curbs and Caissons, Sinking, partly by open dredging and partly under compressed air, and completion of Wells to low-water level.

Copies of the contract documents and diagram drawings can be obtained from the Company's Office, for which a fee of £2 will be charged, which is not returnable.

Tenders, enclosed in sealed envelopes, addressed to the Chairman and Directors and endorsed "Tenders for Bridge Pier Foundations," must be delivered at the Company's Offices not later than Twelve Noon on Monday, the 17th September, 1928.

The Directors do not bind themselves to accept any or the lowest Tender.

By Order of the Board,
R. G. McGECHIE,
Secretary.

199, Gresham House,
Old Broad-street, E.C. 2,
5th July, 1928. 8981

The Madras and Southern
MAHRATTA RAILWAY COMPANY, Limited, invite TENDERS for :—

GIRDER BRIDGE SPANS of 15ft., 21½ft. and 36ft. (approximate total tonnage equals 55½ tons).

Tenders are due in on Wednesday, 25th July, 1928, by 10.30 a.m.

Tender form obtainable at address below ; fee One Guinea, which is not returnable.

The Directors do not bind themselves to accept the lowest or any Tender.

Company's Offices :
25, Buckingham Palace-road,
Westminster, S.W. 1. 8948

The South Indian Railway Company,
LIMITED.

The Directors are prepared to receive TENDERS for the SUPPLY of—

1. DOG SPIKES, SCREW SPIKES, FISH-BOLTS and NUTS.
2. STEEL BEARING PLATES for F.B. Rails.
3. MISCELLANEOUS ARTICLES and MATERIALS.
4. INDIA-RUBBER HOSE, SHEETS, &c.
5. SPARE PARTS for TRAIN LIGHTING CELLS.

Specifications and forms of Tender will be available at the Company's Offices, 91, Petty France, Westminster, S.W. 1.

Tenders, addressed to the Chairman and Directors of the South Indian Railway Company, Limited, marked "Tender for Dog Spikes, Screw Spikes, Fish-bolts and Nuts," or as the case may be, must be left with the undersigned not later than Twelve Noon on Friday, the 20th July, 1928.

The Directors do not bind themselves to accept the lowest or any Tender.

A charge, which will not be returned, will be made of 10s. for each copy of Specifications Nos. 1, 2 and 3 ; and of 5s. for each copy of Specification No. 4 ; and of 2s. 6d. for each copy of Specification No. 5.

Copies of the drawings may be obtained at the offices of the Company's Consulting Engineers, Messrs. Robert White and Partners, 3, Victoria-street, Westminster, S.W. 1.

A. MUIRHEAD,
Managing Director.

91, Petty France,
Westminster, S.W. 1,
4th July, 1928. 8983

SITUATIONS OPEN

COPIES OF TESTIMONIALS, NOT ORIGINALS, UNLESS SPECIFICALLY REQUESTED.

WANTED, ENGINEER for Inside Sales Department. Experience in Power Transmission and knowledge of German essential ; age 24-30.—Write, giving fullest particulars as to age, experience, and wage required, to EMPLOYMENT DEPARTMENT, Hans Renold, Ltd., Burnage Works, Didsbury, Manchester. 8963 A

WANTED, MILLWRIGHT, with Knowledge of Electrical Machinery, for a Concentrating Mill in the South of Spain. Knowledge of Spanish desirable. Salary £40 per month.—Write, stating age, experience, and references, to Box L. 610, Willing's, 133, Moorgate, London, E.C. 2. 8880 A

ASSISTANT for Development, Research and Investigation. Thorough technical education essential, with good knowledge of Electrical Design. State age, qualifications and salary required.—NEWTON BROTHERS (DERBY), Ltd., Derby. 8879 A

CONSTRUCTIONAL STEEL WORK DESIGNER REQUIRED for London Consulting Engineer's Office. Must be conversant with requirements of 1909 Building Act. State experience and salary expected.—Address, P4711, The Engineer Office. P4711 A

GENERAL MANAGER WANTED in London district for Works manufacturing Fancy Silver-coated Articles ; must have good commercial and works experience, and be a good sales organiser. Only those possessing these qualifications need apply.—Write, giving full particulars of experience, age and salary expected, to Box 464, Sells, Fleet-street, E.C.4. 8084 A

GENTLEMEN WANTED to REPRESENT (on Commission basis) progressive FIRM of Reinforced Concrete and Steel-frame Building Specialists in important Industrial centres. Only those with established connections need apply.—Write, INDUSTRIAL CONSTRUCTIONS, Ltd., 44, Grosvenor-place, London, S.W. 8955 A

LEADING INSURANCE COMPANY REQUIRES SERVICES of an additional LIFT INSPECTOR. Candidates must have had a sound theoretical and practical training in the design, erection and maintenance of Lifts and Hoists, and preferably some drawing-office experience. Commencing salary £260. Age 26/28 years. Appointment subject to strict medical examination.—Address applications, with full particulars, P4722, The Engineer Office. P4722 A

MANAGER REQUIRED to Take Complete Control of small East Coast Shipyard and Marine Engineering Works employing about 140/150 men. Must be conversant with the building of Machinery, Drifters, Trawlers, Tugs and Small Coasters. Knowledge of costing very desirable ; able to manage labour. Good salary and commission on profits for right man ; possibly would be offered seat on board of directors.

Address, stating experience, qualifications, &c., P4715, The Engineer Office. P4715 A

REPRESENTATIVES REQUIRED for North-East and Clyde Districts by Firm of Refrigerating Engineers. Must have sound technical knowledge of Ship and Land Installations and business ability. Salary and commission basis.—Address, 8951, The Engineer Office. 8951 A

REQUIRED for Important British-owned Railway in Brazil, JUNIOR CIVIL ENGINEERS, preferably with some railway experience, age not over 28, single. Starting salary £400 p.a. on three years' agreement. First-class passages provided.—Write, giving full particulars education, training and experience, with copies (only) of testimonials, to Box B. J., c/o Davies, 95, Bishopsgate, E.C. 2. 8972 A

WALLIS and STEVENS, Ltd., Basingstoke, REQUIRE TRAVELLING REPRESENTATIVE for Southern District to work from Basingstoke. Principal line, Road Rollers and Road Haulage Plant, &c. Good address and Engineering Knowledge essential. Age 25-35.—Applications by letter in first place only. P4661 A

WORKS MANAGER WANTED in London District. Must have experience in Tooling Ebonite, Erinoid and Similar Materials, and good Knowledge of Electro-plating ; must also be capable of organising Costs and Stores Department.—Write full particulars of experience, age and salary required, to Box 465, Sells, Fleet-street, E.C. 4. 8965 A

CAPABLE MECHANICAL DRAUGHTSMAN REQUIRED for London. Elevator and Conveyor experience an advantage.—Address, giving age, salary expected, and when free, 8967, The Engineer Office. 8967 A

DRAUGHTSMAN, Knowledge Water-tube Boilers, experience Powdered Fuel Installation an advantage, REQUIRED IMMEDIATELY.—Address, giving fullest particulars and salary expected, 8986, The Engineer Office. 8986 A

DRAUGHTSMEN (TWO) REQUIRED for Estimating Department of Structural Engineers in the North ; must be able to Design all Types of Steel-framed Structures for home and abroad.—State age, experience and salary expected, to "STRUCTURAL," Wm. Porteous and Co. (Advertising Agents), Glasgow. P4735 A

DRAUGHTSMAN WANTED, Accustomed to Ventilating, Dust Removing and Fan Work generally. State age, experience fully, and salary desired.—MATTHEWS and YATES, Ltd., Swinton, Manchester. 8976 A

JUNIOR DRAUGHTSMAN REQUIRED for Commercial Motor Engineering Firm in North Finchley. Accustomed to chassis design ; must have good knowledge of this class of work.—Address in first instance, enclosing testimonials, P4726, The Engineer Office. P4726 A

ONE or TWO JUNIOR DRAUGHTSMEN REQUIRED for large works in the Midlands, accustomed to the detailing of Elevators, Conveyors and Structural Work. Applicants must state age, experience, salary required, and when at liberty.—Address, 8953, The Engineer Office. 8953 A

REQ. by London Firm, a Smart CONSTRUCTIONAL ENGINEER'S DRAUGHTSMAN, able to design, &c. State age, experience, and salary required.—Address, 8969, The Engineer Office. 8969 A

TURBO-COMPRESSOR DESIGNER.—An Experienced MAN REQUIRED, capable of taking a leading position in drawing-office.—Apply by letter, stating age, previous experience, and salary required, to REAVELL and CO., Ltd., Ipswich. 8977 A

TWO STRUCTURAL DRAUGHTSMEN WANTED IMMEDIATELY. Must have sound knowledge of Steel-frame Building Construction, Roof Work, &c.; sound theoretical knowledge essential.—Apply, stating age, previous experience, and salary required, to the CHIEF ENGINEER, Messrs. Drew-Bear, Perks and Co., Ltd., Battersea Steel Works, Wellington-road, London, S.W. 11. 8974 A

REQUIRED by Important English-owned Railway in Argentina, JOINERS' SHOP FOREMAN of good experience, thoroughly competent, able to order materials from drawings, make piecework prices, good organiser, capable of handling men. Starting salary £450 on agreement. Free passage.—Reply, giving details training and experience, age, &c., with copies (only) of testimonials, to Box F. G., c/o Davies, 95, Bishopsgate, E.C. 2. 8954 A

SITUATIONS WANTED

ADVERTISER (A.M.I.C.E. and A.M.I.M.E.) is desirous of OBTAINING an EXECUTIVE POSITION with a Firm of Standing ; engineering experience was obtained in his early career ; but in recent years has held important commercial positions, such as general manager to a manufacturing company with an extensive world-wide selling organisation, with excellent results in turnover and organisation ; he has travelled widely in Great Britain, the Continent and the Dominions and a knowledge of the varying conditions in many countries has been gained ; energetic, with the gift of handling personnel, he is requiring a position where there is scope for mutual benefit. Excellent credentials will be given.—Address, 8982, The Engineer Office. 8982 B

AUTOMOBILE ENGINEER, 20 Years' Experience, DESIRES POSITION as Chief Engineer or similar. Highly successful designer of modern passenger and goods-carrying vehicles, used to control of large drawing-office and experimental staff.—Address, P4710, The Engineer Office. P4710 B

CHARTERED CIVIL ENGINEER, Highest University degrees, post grad. scholar, 5 years' exp. earth, water, and sewage works, heavy R.C. const., subaqueous work, precise survey, &c., DESIRES POST with Firm of Consulting Engineers or Contractors.—Address, P4716, The Engineer Office. P4716 B

ENGINEER (29) DESIRES CHANGE. Public school ed., exp. erection and maintenance iron, steel works and rubber factory, shops, D.O. and assist. engineer.—Z.B. 169, Deacon's, Fenchurch-ave. 8975 B

ENGINEER, Aged 30, Single, Indentured Apprenticeship to locomotives, 2½ years' sergeant mechanic (aero-engines) with R.A.F. during war, directors' scholarship and drawing-office, First-class Engineers' Certificate, marine, triple-expansion, turbine, refrigerating and oil fuel experience, earnestly DESIRES POSITION. Will start at bottom if a chance to rise. Willing to learn a language and go abroad.—Address, P4727, The Engineer Office. P4727 B

ENGINEER (Chief B.O.T.) (31) DESIRES APPOINTMENT, maintenance preferred ; excellent references.—Address, P4734, The Engineer Office. P4734 B

EXPERT ENGINEER REPRESENTATIVE, Fully trained, shops and D.O., extensive travelling experience, with specialities, is OPEN for ENGAGEMENT.—Address, P4720, The Engineer Office. P4720 B

MECH. and ELEC. ENGR. (31), with Works, D.O. and sales experience, REQUIRES COMMERCIAL POST. Good knowledge export trade and languages.—Address, P4731, The Engineer Office. P4731 B

PRACTICAL ENGINEER OPEN for RE-ENGAGEMENT. Progressive post. British Possessions preferred. Aged 24, single, total abstainer, healthy, strong, well recommended. Present post 2½ years, Central Africa, entire charge plants and native labour. Good experience town, suction gas plants and engines, oil and steam maintenance and installation, general eng. repairs, turning, fitting, screw cutting, mechanics, maths., drawing. In England mid-July. Devonian.—MARTIN, 1, Baker-street, Heavitree, Exeter, Devon. P4732 B

QUANTITY SURVEYOR, British (25), at Present on contract in Argentine Republic, disengaged from end of 1928, SEEKS new POST at home or abroad. Experienced in estimating and adjusting contracts for building, railway and engineering works ; speaks Spanish.—Address, P4713, The Engineer Office. P4713 B

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For continuation of Small Advertisements see page 4.

JULY 6, 1928.—VOL. CXLVI.

THE ENGINEER.

A Seven-Day Journal

Financing the Research Associations.

WHEN the scheme for the establishment of industrial research associations was first drawn up, it was arranged that the Department of Scientific and Industrial Research should for a period of five years contribute to the funds of each association an annual grant on the basis of one pound for every pound received by the association in the way of subscription from the firms supporting it. As the five-year periods began to expire, it was found that in several instances the withdrawal of the Government assistance threatened to cripple or even terminate the work of the associations. The scheme was reviewed, and it was decided, subject to a satisfactory report being received on the working of the associations, to continue the subsidies, on, however, a diminishing scale, for another period of five years. At the end of the ten years, it was anticipated, the industries would be in a position to maintain their associations without Government assistance. That expectation, it would now appear, is not likely to be fulfilled in all cases. So, at any rate, we infer from the fact that on Friday, June 29th, a deputation, representing nineteen associations, waited on Lord Balfour for the purpose of urging the Government to extend still further the period of assistance. Lord Balfour announced that the Government had decided to make a further offer of grant on a pound per pound basis, provided the subscription income exceeded a minimum which would be fixed in each case by the Department's Advisory Council. The maximum sum to be granted would also be fixed by the Advisory Council. The grants, subject to these qualifications, would be paid for a period of five years, which in suitable cases would be extended to ten years.

Rhine Navigation.

THE intention of Germany and Switzerland to carry through the work of canalising the Rhine, in opposition to the scheme for a lateral canal, which is to be constructed by the French in Alsace, seems to have been confirmed by an important gathering at Friedrichshafen, when measures were discussed for continuing the work of rendering the Rhine navigable between Strasburg and Lake Constance, and of constructing a canal between the lake and the Danube, whereby the Rhine would become a waterway for Central Europe. There is evidently a strong objection to the waterway being dependent upon the French canal. On the other hand, the French point of view is that the Alsace canal has become a necessity and that it is simply a waste of money to attempt to make a navigable channel between Strasburg and Basle so long as the Istein obstruction exists. The Kembs section of the canal has already been begun, and it is expected that the actual work of cutting the canal will be started upon in a few months' time. It is believed that the Germans and Swiss will finally come round to an acceptance of the Alsace canal as offering the only safe and economical means of navigation. At present most of the work they are carrying out is above Basle, where several important power stations are to be constructed.

Co-operation of Acetylene and Welding Societies.

A MATTER of interest which arose at last week's annual meeting of the British Acetylene and Welding Association was a proposal for the closer co-operation of the Association with the Institution of Welding Engineers. The Association was formed some years ago, but it was felt that, although it was doing excellent work, its field of operation was rather narrow, and that there was need for an association to deal with electrical and other types of welding. As a result, the Institution of Welding Engineers was formed. It was soon realised, however, that the existence of two organisations with somewhat similar objects was not conducive to the general advancement of the interests of the welding industry, and efforts have been made from time to time to amalgamate them in some form. A joint committee of the two bodies has recently been at work and has produced recommendations for co-operation. Its report has been adopted by the two Councils, and general meetings of the members have signified their approval. It was stated at last week's meeting that the Association had felt a difficulty in acting in the dual capacity of a trade association and a scientific association. The joint committee agreed that there could be no question of amalgamating the two bodies into one, as it was essential that, apart from the question of welding, the existence of an association devoted expressly to the interests of the acetylene industry must be maintained. It was agreed also that the finances of the two bodies must remain entirely apart. It was proposed that the name of the Association should be altered to "The British Acetylene Association," and that its membership should be restricted to firms manufacturing or selling acetylene, acetylene apparatus, carbide of calcium and oxygen and their employees. The Institution is to confine its activities to promoting the extension of the use of welding in all its branches and to the advancement of the science of welding. Its membership is to be confined to individuals.

A New Beet Sugar Factory at Taunton.

A NEW beet sugar factory is to be built at Norton Fitzwarren, 2 miles from Taunton, by Sugar Beet and Crop Dryers, Ltd., the company which has purchased the rights of the Oxford process of sugar manufacture lately introduced by Dr. W. J. Owen. A full account of the process was given in THE ENGINEER of April 22nd, 1927. After washing and slicing, the beet "cosettes" are subjected, it will be recalled, to a drying process, which enables them to be kept indefinitely without risk of deterioration. Under the new system a series of drying stations is to be established to supply the factory with the raw beet and enable it to work continuously throughout the year. The new factory at Taunton will at first take the form of a drying station, and arrangements have been entered into, we understand, whereby supplies of beet in amount close upon 20,000 tons will be drawn from 2000 acres in Dorset and Somerset. Next year it is intended to enlarge the factory so that it can also deal with beet supplies from Devon and possibly Cornwall, while later on extracting plant will be put down together with three other drying stations, each one of which will be designed to deal with 25,000 tons of beet per annum. In the first year the dried "cossettes" produced at Taunton will be forwarded to the Eynsham factory near Oxford for extraction. The company claims that by the new process the operating costs are reduced and that a larger yield of sugar is obtained from a given quantity of beet. The development is an important one both as regards the process itself and the effect it will undoubtedly have on agriculture and industry in the West of England.

Lead Mining in Flintshire.

IT seems possible that a revival in the lead mining industry of North Wales may take place following the amalgamation of nine hitherto separate lead mining undertakings to form Halkyn District United Mines, Ltd., which company, together with the separate firm of Halkyn District Mines Drainage Company, will undertake certain measures for the draining of the Flintshire mining area. The Halkyn area is at present drained by the Milwr tunnel, which has been driven 3 miles at sea level from the Dee at Bagillt into the lead mining field. By means of this tunnel certain mines are now drained to a depth of 200ft. above Ordnance Datum, but as the veins have been already worked out to that level a new drainage scheme must be undertaken. It is proposed to continue the Milwr tunnel a further 3 miles to Rhydymwyn, and later to carry .. 6 or 7 miles still further south into the Llanarmon drainage area. The tunnel which it is proposed to construct will lie centrally with the ore-bearing districts and it will be built to accommodate a tramway and to tap various ore-bearing veins by means of side galleries. With the adoption of modern tunnelling methods it is hoped to drive the new shaft at the rate of several hundred feet a month, but even under favourable conditions close upon three years will be required to complete the scheme. It is calculated that at the present time upwards of 20,000 gallons of water per minute are discharged into the river Dee from the existing drainage tunnels. This quantity will be greatly increased, and as a consequence the cost of pumping at the mines will be reduced.

The Railways' Road Transport Bills.

AFTER an inquiry extending over thirty-four days, the Joint Select Committee that has been inquiring, under the chairmanship of Lord Chelmsford, into the application of the four grouped railway companies and of the Metropolitan Railway for powers to own and operate road transport, concluded its inquiry on Thursday, June 28th, and announced that the preamble of the Bills of the larger companies had been proved, but not that of the Metropolitan. It was, however, announced that the administrative county of London was to be excluded from the scheme and that all municipally owned tramways and omnibus undertakings were to be protected. Counsel for the railway companies volunteered to insert clauses that would authorise the Ministry of Transport to interfere if the companies failed to exercise or exceeded their duties, and also to regulate fares. A noteworthy feature of the conclusions of the Committee was its emphatic opinion that legislation for controlling road traffic was of the utmost urgency, but the present Bills should not await such general legislation.

North Wales Power.

AT the twenty-second ordinary general meeting of the North Wales Power Company, Ltd., held at Caxton Hall, Westminster, a few days ago, the chairman, Mr. Kenneth M. Clark, said that the profits for the year amounted to £47,571. During the year under review construction work had been actively pushed forward, and eighty-seven additional miles of transmission line had been completed, making a total of 340 miles in service. The principal lines completed were those extending the supply to Oswestry, interconnecting Wrexham and Legacy sub-station with Hawarden sub-station, and making a supply available to the Mold Urban District Council. The lines duplicating the service to Rhyl Urban District Council and giving a supply to Prestatyn Urban District Council were also completed. The 66,000-volt line between Legacy and Crewe had been completed, and would shortly be brought into commission. The construction of the main 66,000-volt transmission line between the new station at Maentwrog and the Legacy sub-station at Wrexham should be finished next month. The opening of the power station at Maentwrog would diminish the company's purchase of current from outside sources. Bulk supplies were being given to forty towns and villages, and there was no doubt that the number would be increased in the near future. During the period covering the construction of the new works, which were practically completed, the company had not been in a position to generate more than approximately 20 per cent. of the electricity needed, and consequently it had been compelled to purchase about 80 per cent. of the total current required by its consumers. With the completion of the Trawsfynydd dams and the Maentwrog generating station, however, it was estimated that in 1929 the company would be able to generate 78 per cent. of the electricity required. The sale of electricity last year was 26 per cent. in excess of that of the previous year. The company's consulting engineers, Sir Douglas Fox and Partners, had furnished a report on the further development which would become necessary at Trawsfynydd and Maentwrog to meet the ever-increasing demand for electricity, and their opinion was that the development could only be effected by extending the company's watershed and increasing the storage capacity. The report had been carefully considered by the directors, who had decided to negotiate for the further capital required to enable the company to proceed with the work.

The Royal Show at Nottingham.

No. I.

ALTHOUGH the present Government is showing a sympathetic attitude towards agriculture in the Valuation and Rating Bill which it is now introducing, that alone will not suffice to restore this great national industry to a prosperous condition. Improved methods of production, transportation and marketing will need to be employed, and for these purposes the aid of the engineer and the chemist will be required more than ever before. Increased rents, higher wages and shorter hours of labour have placed British farmers at a disadvantage compared with their overseas competitors, and labour-saving machinery must be employed if land is to be made to pay its way. For instance, with the aid of a tractor a farmer can plough four or five times as much land in a given time as can be done by a team of horses and by carrying out these operations more quickly it is possible to avoid delays caused by the weather—a matter of considerable importance in a climate such as ours.

To take the fullest advantage of mechanical aids, the farmer and his workers need to acquire a certain amount of engineering knowledge in these days, both for the selection of the implements and for their maintenance, and it is at Exhibitions such as that promoted by the Royal Agricultural Society that such knowledge can be obtained.

The show of implements and machinery which opens on July 10th at Nottingham will comprise exhibits at rest, and in motion, and it is gratifying to note that, in spite of the prevalent depression in the agricultural implement industry, the number of stands in this section is greater than at any recent Show since Cambridge in 1922, and exceeds those at the Show which was held at Nottingham in 1915. The number of stands is 467, and there are 12,000ft. of shedding in the implement yard, compared with 339 stands and 10,704ft. in 1915. As regards livestock, poultry and produce, the Society has cause for satisfaction. The number of horses shown is 607, cattle 1261, sheep 591, pigs 833, poultry 1036, and produce 365. As might be expected, the Royal Agricultural Society of England—to give it its full title—is very conservative, and its Council is very slow to admit any changes or alterations in its procedure. This is shown by its lack of initiative in connection with the implement section. The Society cannot be accused of excessive generosity in the matter of awards for new machinery, a batch of silver medals being all that is to be competed for, whereas in the livestock section prizes are given away amounting to thousands of pounds annually.

The most important development in connection with the power supply for farms and estates during the last few years has been the application of electricity, and electric motors are now being used extensively for milk separators, pulp cutting, pumping, grinding, &c. This branch of engineering is being well catered for by numerous firms, which are building simple, efficient and reliable generating plants at prices which a few years ago would have been considered impossible. We have in mind one lighting set of ¾ kW which can be purchased for £55. This comprises a single-cylinder petrol engine and direct-driven dynamo.

Another recent development is the cultivation of the land by means of rotary tillers, which for some purposes are ousting the plough. With the rotary tiller, instead of the ground being cut into furrows, it is torn up into small particles, whereas the plough cuts and wedges the soil up and over. Rotary tillers can be used fairly successfully on stony ground, as well as on hard-baked clayey ground, but on land that is "foul" with weeds having long roots the tendency for the weeds to bind round the milling shaft is likely to cause trouble. For potato planting and for surface cultivations, such as is required in beet and fruit plantations and hop gardens, rotary cultivators are well adapted. One well-known example of tiller, the Simar, is operated by a petrol engine which drives the road wheels by worm gearing and the milling tines by bevel gearing, either or both of which can be put into operation by clutches on the main driving shaft. A pulley attached to the front end of the crank shaft is also provided for driving stationary machinery. The engine in this case gives from 7 to 10 horse-power, the width of track is 36in., and the depth of tillage from 1in. to 10in. A ridger to follow the miller can be fitted when desired.

The disc harrow is a very useful implement. It consists of two sets of steel discs mounted at an angle to one another on a framework. The convex faces of the discs in each set are set towards the centre, and each disc is therefore at an angle to the line of draught, the angle being adjustable. As the discs are drawn through the soil they cut through any clods, while lifting, turning and pulverising the soil. Howards of Bedford will show a new implement of this class with 18in. discs. The machine has a rocking forecarriage and the disc gangs are fitted with distance pieces of special design, and strong bolts to prevent the possibility of the discs working loose. The bearings carrying the disc gangs have grease lubrication by pipes projecting above the gang frames. This well-known firm will also exhibit the new potato digger which obtained a Silver Medal last year, several new designs in ploughs, and a petrol locomotive with rack gearing.

ROBERT HUDSON, LTD.

Robert Hudson, Ltd., Leeds, will exhibit a 24in. gauge lay-out of 20 lb. light railway track with crossings and curves, on which will run an internal combustion locomotive hauling a train of rolling stock, comprising a wagon suitable for carrying potatoes, a double bogie wagon for sugar beet and other roots, as well as timber wagons carrying felled trees and other long articles. The 20 H.P. 4-ton four-wheels coupled internal combustion locomotive is specially designed for rough work, and is fitted with the well-known Fordson power unit. It is very low in first cost and upkeep, and the change-speed gear has been specially designed so that unskilled drivers can change gear with ease. Two speeds are provided, namely, 2·4 and 6 miles per hour. The wheel base is 36in.

The double bogie sugar beet wagon is suitable for light tracks and has a timber body with drop sides, which can be secured in a horizontal position, thus enabling the wagon to be quickly transformed into a wide platform car, suitable for the transport of hay, straw, or other light bulky material. The capacity is approximately 108 cubic feet, the internal dimensions of the body being 13ft. 2in. long, 4ft. 10in. wide at the top, 3ft. 3½in. wide at the bottom, and 2ft. 1½in. deep. The main frame is made from rolled steel

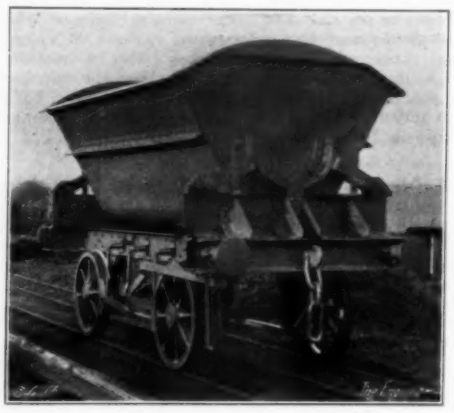


FIG. 1—SIDE-TIPPING WAGON—HUDSON

channels with rounded ends, forming dead central buffers, which are fitted with link and pin couplings. This frame is mounted on two four-wheeled bogies, one of which is fitted with a screw brake gear acting on all four wheels and operated from the main frame. The bogie frames are made from rolled steel channels, with suitable swivelling centre castings, and are mounted on 14in. diameter cast steel wheels pressed fast on mild steel axles, with machined outside journals running in dust-proof roller bearing axle-boxes. The potato wagons are used extensively in the potato farming districts, and can also be used for many other purposes. The frames are made from rolled steel channels with rounded ends forming dead central buffers. The timber platforms are 6ft. 4in. long by 5ft. 6in. wide. The wheels are 14in. diameter cast steel fast on mild steel axles, with outside journals running in dustproof roller bearing axle-boxes to suit 24in. rail gauge.

The same firm will also be showing a 20 H.P. 6-ton four-wheels coupled internal combustion locomotive, 4ft. 8½in. rail gauge, suitable for buffing and coupling with main line stock—Fig. 7, page 4. This locomotive will haul loads up to 150 tons on the level, and is particularly suitable for private siding work. With the locomotive is to be shown a 300 cubic foot capacity automatic double side-tipping wagon, 4ft. 8½in. rail gauge, suitable for buffing and coupling with main line rolling stock—Fig. 1. These wagons are so arranged that when filled, on releasing a catch, the body automatically discharges its contents, remaining in the tipped position until another catch is released, when it automatically returns to the upright position ready for refilling. They are particularly suitable for filling by means of a steam shovel or other forms of mechanical loader. To demonstrate their capabilities and easy working, a drag line excavator is to be employed to fill one of these wagons, which will be emptied automatically. The wagons are of very strong construction throughout, and suitable for 15-ton loads. The bodies are made from mild steel plates, suitably stiffened and jointed by rolled steel sections. The frames are of rolled steel channels and joists well gussetted and cleated together, with channel standards stayed and fitted with compression catches to prevent accidental tipping of the body. Side spring buffers and central spring draw gear are also fitted, the whole being mounted on 36in. diameter steel tired wheels and axles with inside journals running in cast iron axle-boxes, fitted with brass bushes and laminated bearing springs to suit 4ft. 8½in. rail gauge. Side lever brakes are also fitted, although they can be dispensed with if desired. The length over the buffers is approximately 16ft. 8in., the length of the body being about 12ft., with an overall width of 7ft. 10½in. and an overall height of 9ft. 6in.

MARSHALL, SONS AND CO., LTD.

Marshall, Sons and Co., Gainsborough, will show a representative group of their latest products. It is to include two steam road rollers, a portable steam engine, oil engines, a steam traction engine, thrashing machines and concrete mixers. One of the steam road rollers, 10 tons single-cylinder type—Fig. 9—is fitted with a piston valve engine, radial valve gear, ring oiler bearings for the crank shaft and other refinements. The most notable feature, however, is the method of construction of the rollers. Each has its hub, spokes and rim combined in a substantial steel casting, thus obviating trouble with loose and broken spokes sometimes met with in wheels of built-up design. This roller is fitted with an "Allen" type two-tine scarifier. The other roller—Fig. 8—known as the "Marshall-Universal," is a type brought out to meet present-day demands for a road roller equally serviceable for ordinary consolidation and for "carpeting" with asphalt and similar surfacings. To meet these conditions, it is fitted with a double-cylinder, high-pressure, splash-lubricated, enclosed engine with piston valves and quick-action reversing gear, so that when used on asphaltic surfacing, dwell is obviated and carpeting is done without waves or corrugations. In this roller, the main axle is articulated and is adjustable for any desired road camber—a feature which has favourably impressed many surveyors and contractors in different parts of the country. An "Allen" scarifier is fitted on the back of the tender, so that it will slide either to the right or left of the engine. Thus, practically the whole of a road surface can be scarified without turning the engine round.

The portable steam engine is fitted with piston valve gear and ring oiler bearings to the crank shaft. It is an engine remarkably economical in fuel consumption, owing to the high evaporative capacity of its boiler and the mechanical efficiency of the engine itself. The latter under test has been proved to be 94·5 per cent. and the fuel consumption attains the remarkably low figure of 2·05 lb. per B.H.P. per hour.

The oil engine group will comprise a 60 brake horse-power vertical heavy-oil engine—Fig. 2—a

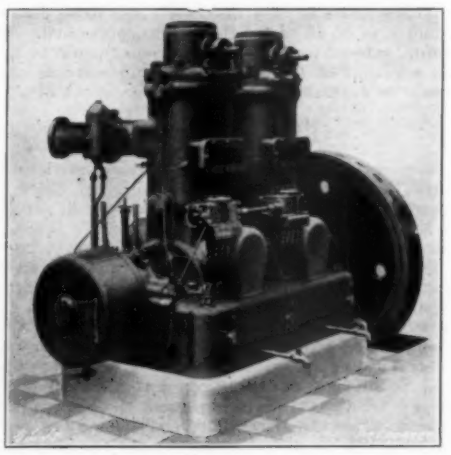


FIG. 2—60 B.H.P. OIL ENGINE—MARSHALL

portable horizontal engine, 20 B.H.P., and a horizontal fixed engine, 12 B.H.P. The two latter are standard hot-bulb engines for crude oil, and they represent the type which has proved so highly satisfactory for agricultural and general power services all over the world. The vertical engine is one of the firm's new series. It is of the two-stroke valveless type, employing intermediate compression pressure and having a quick-start device consisting of a glowing plug in conjunction with a battery and charging dynamo. By these means, reliable and rapid starting is obtained, which, for practical purposes, is comparable with results obtained with engines of the "cold-starting" type. It is an extremely smooth running engine and its fuel consumption at full load comes out at a very economical figure.

A. RANSOME AND CO., LTD.

An extensive display of wood-working machinery is to be made by A. Ransome and Co., Ltd., Newark-on-Trent. All the machines are of the most recent design. We have selected for special notice a small portable band saw—Fig. 3—a forestry saw bench mounted on road wheels and driven by a petrol engine—Fig. 4—and a bench hand-feed planer—

Fig. 5. The small band saw is driven by a quarter brake horse-power electric motor and spur gearing, and can be used for a variety of curved and straight work. The saw pulleys are 14in. diameter and of special design. They are covered with a leather band permanently fixed to the rim. The top pulley can be canted by the finger and thumb. The table, 14½in. square, is mounted on a quadrant which allows it to be tilted through an angle of 45 deg. Adjustable saw guides, both above and below the table, are provided; a roller takes the back thrust, and the side guides are hard steel plates. Both pulleys are

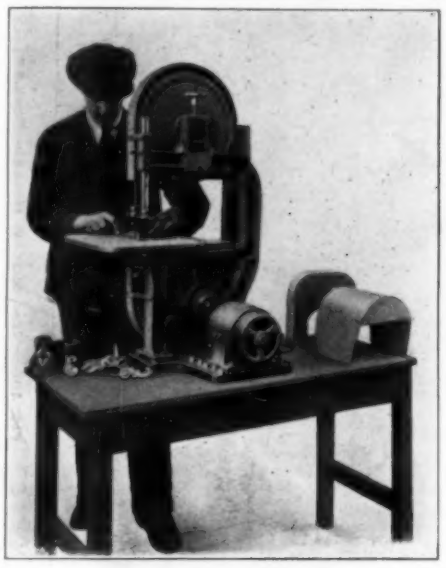


FIG. 3—PORTABLE BAND SAW—RANSOME

enclosed in strong guards, which are mounted on one upright carried on a pair of strong hinges, and can be quickly swung to give access for changing the blades.

The forestry saw bench shown in Fig. 4 is mounted on a four-wheel truck on which is also carried a horizontal petrol engine which drives the saw by means of a belt and fast and loose pulleys. The bench has a deep top, which is of rigid construction and cast in one piece. It rests on two separate side frames, which are held together by means of cross ties, the loose pulley being carried on a spindle mounted on an outside bracket carried on a floor stand, which is

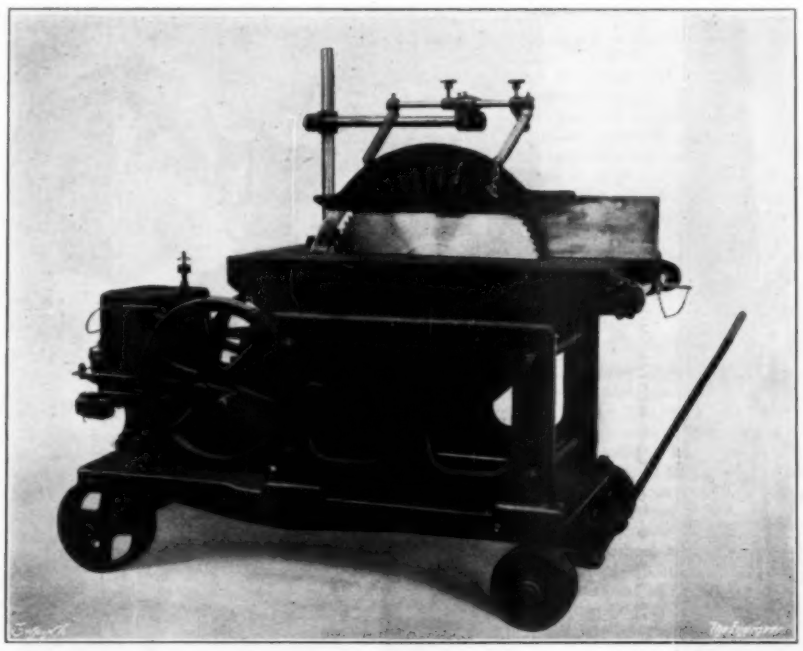


FIG. 4—PORTABLE PETROL-DRIVEN SAW BENCH—RANSOME

also, in turn, firmly fixed to the back side frame of the bench. The front edge of the bench top is grooved to take a cross-cutting slide when required. The saw spindle is carried in roller and ball bearings mounted in a housing frame, which is bolted to the underside of the table top on machined faces. This arrangement enables this unit to be removed with the spindle and bearings set up and ready for use, and yet to be placed within the area of the table top for packing purposes for overseas. The loose pulley is mounted on a separate fixed spindle and revolves on ball bearings. The fence consists of a plain support at right angles on which slides an adjustable front plate to suit varying diameters of saws. It can be quickly moved across the width of the bench top, and instantly locked at any position by means of an excentric locking handle. A fine adjustment is also provided by means of a screw and hand grip wheel, and for cross-cutting it can be turned over the end of the bench top so as to leave the table clear. The maximum distance from the saw to the fence is 11½in. on the 32in. size and 14½in. for the larger bench.

The 6in. bench hand feed planer by Ransomes—Fig. 5—is capable of planing, jointing, plain and stop chamfering, tonguing, grooving, beading, rebating and moulding in any description of timber up to 6in wide. The main standard of the machine consists of a strong casting suitably ribbed and with a wide base to prevent vibration. It has inclined ways

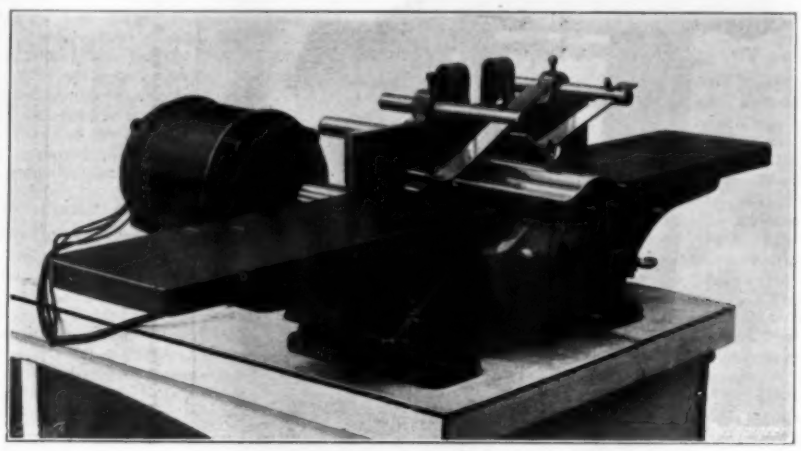


FIG. 5—6IN. BENCH HAND-FEED PLANER—RANSOME

of vee-section planed to receive the table slides and housings bored to receive the cutter block bearings. The cutter block is of special steel, forged solid with the spindle, and of the circular type provided with loose plates for securing the two cutters. The cutter block spindle runs in ball and roller bearings mounted in dustproof housings. The tables for carrying the timber are made in two pieces and connected to the table slides, which are adjustable on inclined ways by hand wheel and screw to regulate the depth of cut. The tables can be independently adjusted from the slides to enable mouldings up to ¼in. thick to be cut; also rebating up to ¼in. deep. Both tables are fitted with steel lips at the ends which overhang the cutter block. There is a long cast iron fence fitted with a canting arrangement for planing on the bevel up to 45 deg. It can be adjusted laterally by means of a plunger sliding on a socket.

JOHN FOWLER AND CO. (LEEDS), LTD.

For the first time John Fowler and Co. (Leeds), Ltd., will have two separate stands, one devoted to agricultural machinery and the other to constructional machinery. The latter will be in the "machinery in motion" section. On the former stand, which will be, as usual, directly opposite the main entrance to the showyard, there are to be shown an I.C. cable-ploughing engine of 70 horse-power, a 6-7 ton steam wagon, an 8-ton compound steam roller, and 40 horse-power petrol shunting locomotive, an Allen scarifier, and a three-furrow anti-balance plough. Readers of THE ENGINEER are already familiar with the main features of these machines. The advantages of the oil engine for the cable ploughing tackle are the great economy effected by the use of heavy oils for fuel, the absence of both magneto and carburetter, and the avoidance of labour for the handling of bulky fuel, either on the footplate or in transit from the depôt to the field of operations; only an insignificant quantity of water is required for cooling purposes, and stand-by expenses are minimised as the engine can be started and stopped at will. This engine provides three cultivating and three road speeds in either direction. The 40 horse-power motor shunting locomotive can haul 350 tons on the level, and it is claimed that it has a higher hauling efficiency than a steam locomotive of the same weight, because of the more uniform driving torque. A new feature has been introduced in connection with the plough in the shape of Copping's patented skim knife coulter—an illustration of which is given in Fig. 6. In many cases, when ploughing in rubbish or top growth where a skim coulter has to be used, the ordinary knife coulter is discarded for the sake of simplicity, and to avoid the trouble of fitting two coulters simultaneously. In this new device the work of the two coulters is performed on one arm. The working parts are all renewable without replacing the main arm or the casting which supports the skimmer share. The knife coulter and share are made of the best share steel, and can be re-knifed when worn. The mould

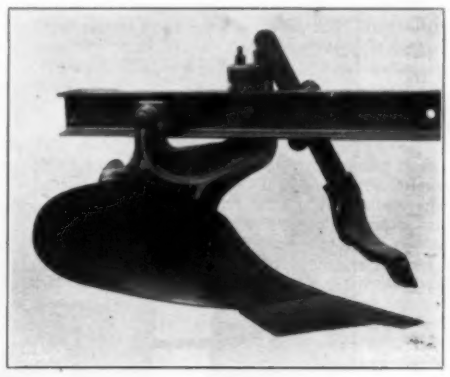


FIG. 6—SKIM-KNIFE COULTER—FOWLER

board is also of special steel, which takes a high polish and wears almost indefinitely.

The 8-ton motor roller, shown by Messrs. Fowler, and illustrated in Fig. 10, is of the three-wheel type, has a four-cylinder engine with forced lubrication to all main and big-end bearings, and the drive is by means of double bevel gear to a cross-shaft and reversing clutches. The bevel drive is totally enclosed, and runs in oil. Two speeds in either direction are provided, and the change speed gear is mounted on two intermediate shafts. The final drive is by spur gearing to the live hind axle. The road wheels are built up of pressed steel plates, and are designed to hold water ballast. The rims are of rolled steel plate. The forecarriage has a patented spring head, the front fork being attached to the head by a pin, leaving the front rollers free to adjust themselves to the unevenness of the road. Steering is effected by worm, worm wheel and chains, and is claimed to be exceptionally light, because, in addition to the ball bearing on the forecarriage head, ball thrust washers are arranged in the worm gear. The magneto is fitted with an impulse starter. The large footplate and control levers make the driving of the roller simple. The whole of the hind end is open for easy access. The starting gear is also carried at the rear end in a

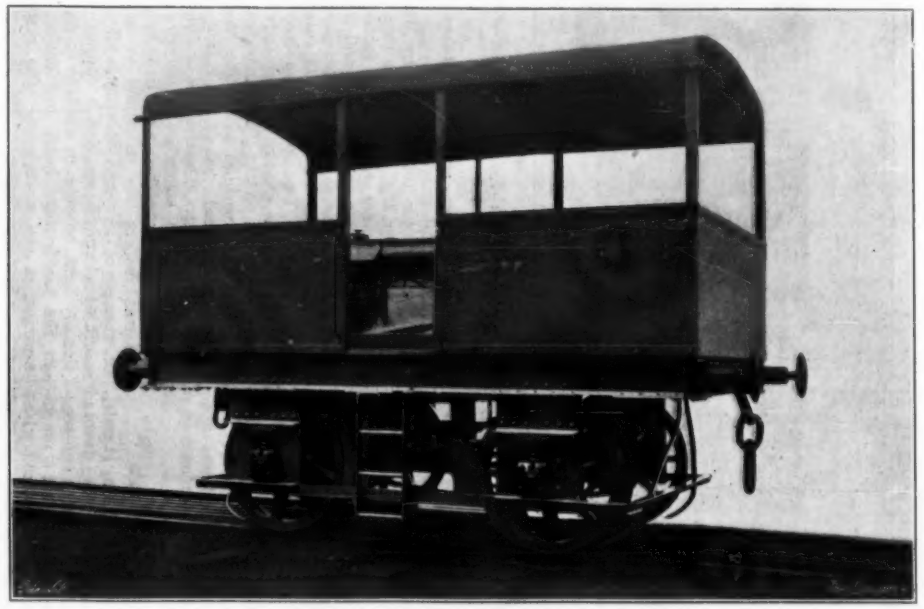


FIG. 7—20 H.P. 6-TON LOCOMOTIVE—HUDSON

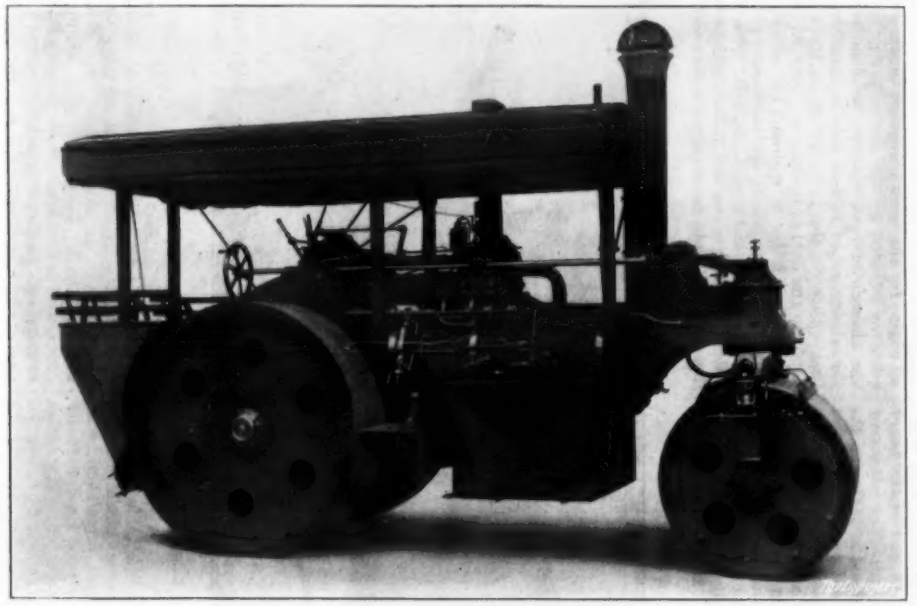


FIG. 8—LIGHT STEAM ROLLER WITH ARTICULATED AXLE—MARSHALL

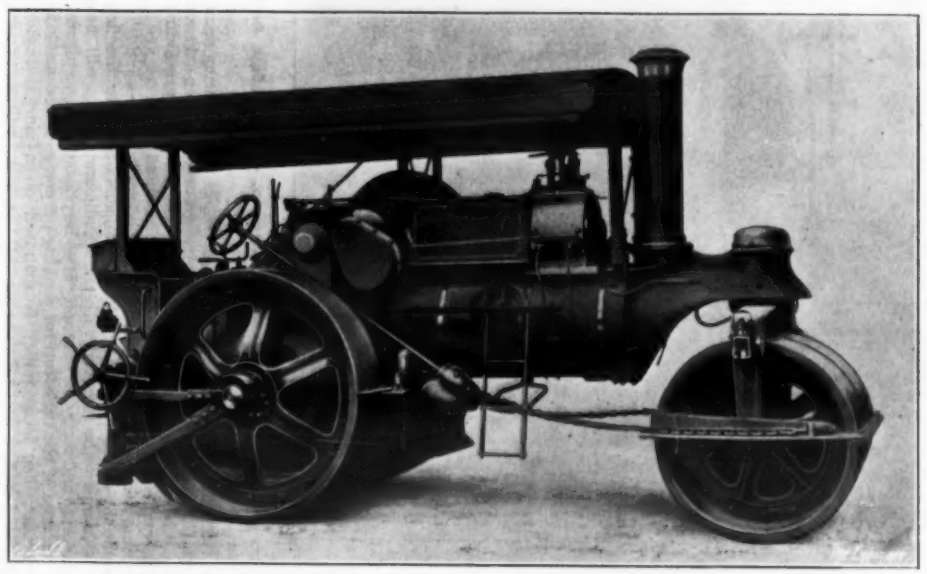


FIG. 9—10-TON SINGLE-CYLINDER STEAM ROLLER—MARSHALL

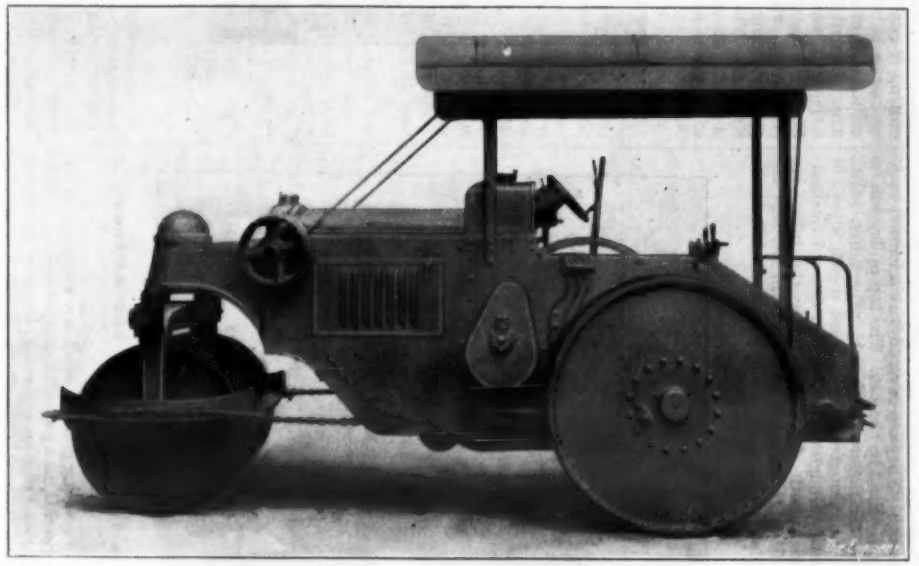


FIG. 10—8-TON MOTOR ROLLER—FOWLER

covenient position. A powerful brake is operated either by pedal or hand lever, and a governor is fitted on the engine to prevent racing in addition to the hand throttle control.

Another useful appliance which is to be exhibited by John Fowler and Co., Ltd., is a 15-cwt. contractor's winch—shown in Fig. 11. This is in one unit, with a 5 horse-power Petter paraffin engine forming a compact self-contained machine controlled by one

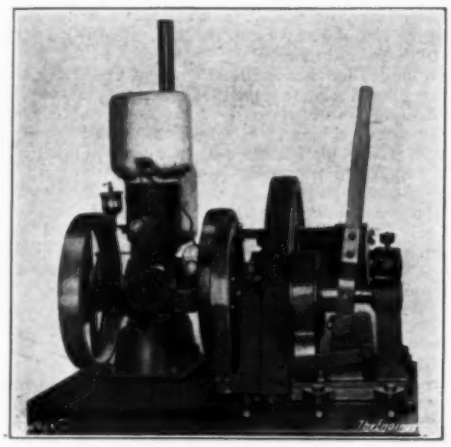


FIG. 11—MOTOR WINCH—FOWLER

lever, which engages the clutch in the forward position, and applies the brake in the backward position. There is no possibility of engaging both engine and brake simultaneously. The power is transmitted from the engine to the winch by a chain and sprocket, and the clutch is of the cone type with a Ferodo lining. The winch will lift 15 cwt. at a speed of 60ft. per minute.

(To be continued.)

Institution of Mechanical Engineers at Southampton.

No. II. (*conclusion*).*

WE conclude below our account of the Summer meeting of the Institution of Mechanical Engineers, which was held at Southampton last week.

On Wednesday afternoon, June 27th, the principal alternative visits were to the Supermarine Aviation Works, the works of J. Samuel White and Co., and the Ordnance Survey Department.

AVIATION WORKS AND SAMUEL WHITE & CO.

The Supermarine Aviation Works were established in 1912, and are situated on the river Itchen at Woolston. They are specially devoted to the design and construction of all types of flying boat. During the past year the works have been extended by the acquisition of 70,000 square feet of floor space at Hythe. The Hythe works are used for testing and for erecting complete machines from components made at Woolston.

The works of J. Samuel White and Co., at Cowes, date from the beginning of the nineteenth century. In their early days they built many steamships for the P. and O. and the Royal Mail companies. For the past fifty years the company has specialised in the construction of torpedo craft, lifeboats, medium and fast ships, yachts, &c. There are six slips, including a covered building berth and a slip capable of hauling up a ship of 1000 tons. The boat-building department has accommodation for the construction of twelve large motor lifeboats simultaneously. The firm's engine works are situated at West Cowes. The fitting-out quay is served by an 80-ton electric revolving cantilever crane and a floating workshop. At present there are under construction three flotilla leaders of 2000 tons displacement for a speed of 36 knots for a foreign navy, and many lifeboats.

ORDNANCE SURVEY.

The headquarters of the Ordnance Survey Department, a Government Department working under the Ministry of Agriculture and Fisheries, are situated in Southampton. The Survey is largely military in character, the superintending staff being mainly composed of officers of the Royal Engineers and the subordinate staff partly military and partly civil. The Department is responsible for the mapping of the British Isles, Ireland excluded. As the survey and original mapping were completed some time ago, the main work now consists of revision and publication of the maps. The Department also undertakes the drawing and printing of maps for the Geological Survey, magnetic and gravity surveys, the acquisition and recording of archæological information, &c. In addition to the headquarters division, there are four divisions engaged on field revision work, which are stationed at Bristol, York, Norwich and Edinburgh. The equipment at headquarters includes a number of cameras, some of them for negatives measuring 45in. by 30in., lithographic and letterpress printing machines, a type-casting machine and a map-mounting machine.

* No. I. appeared June 29th.

On Thursday morning organised visits were paid to the R.A.F. seaplane station at Calshot, to the Pirelli-General Cable Works and to the Southampton Corporation Electricity Works.

AIR FORCE BASE AT CALSHOT.

The Air Force base at Calshot was first used at the end of 1912, and on the outbreak of war was rapidly developed as a seaplane and flying boat training station for the Royal Naval Air Service. It became the headquarters of a number of sub-stations established round the South Coast. The work of the station now consists in giving training in coastal reconnaisance, air pilotage and navigation, and instruction in several trades to airmen. In addition, the station is also the headquarters of No. 480 Flight, which has assigned to it coastal reconnaisance and naval co-operation duties.

PIRELLI CABLE WORKS

The Pirelli-General Company was formed by Messrs. Pirelli, of Milan, and the General Electric Company to manufacture on a large scale all kinds of electric cable and wires. One factory on the Western Shore at Southampton is equipped for the production of all classes of rubber cable and wire. Another factory is now being erected at Eastleigh for the manufacture of paper insulated power transmission cables, and of telephone trunk and distribution cables. In a separate building adjoining the Eastleigh works is a copper wire-drawing plant, where all the wire used by the two works is produced.

SOUTHAMPTON ELECTRICITY WORKS.

The Southampton Corporation Electricity Works are built on piled foundations on reclaimed land at the estuary of the river Test. The area of the site is over six acres, and can be increased when necessary. The plant at present installed and in course of erection has a generating capacity of 27,760 kW., and additional plant to generate 15,000 kW is to be installed next year. The boiler plant consists of ten Babcock and Wilcox boilers generating steam at 200 lb. pressure, and a total temperature of 538 deg. Fah., which is to be increased to 750 deg. Fah. A feature of the station is the Prat steel chimney 100ft. high and 7ft. 10in. maximum internal diameter. This chimney operates on the ejector principle, an induced draught fan withdrawing some of the hot gases from the main flue and projecting them through a jet in a contraction in the chimney stack. An effective draught of 0·75in. of water at the boiler dampers is obtained by this arrangement for an expenditure of only 25 horse-power at the fan motor. The generating plant consists of a Willans and Robinson reactive turbine driving two 600 kW Brown-Boveri direct-current generators, a Cole, Marchant and Morley vertical triple-expansion engine, with Corliss valves driving a Dick-Kerr 1000 kW generator, two B.T.H.-Curtis impulse turbines driving a 1500 kW, and a 3000 kW alternator, a Metropolitan Vickers impulse turbine driving a 5000 kW alternator, and a Parsons reaction turbine driving a 6000 kW alternator. A Fraser and Chalmers-Hick, Hargreaves 10,000 kW turbo-alternator set is in course of erection. The condensing system comprises a pond of about two million gallons capacity, which is replenished at every high tide.

THE CUNARD LINER "AQUITANIA."

Following the morning visits the members and their friends were entertained to luncheon by the Cunard Company on the "Aquitania," and later were shown over the vessel under the guidance of her officers. The "Aquitania" has the distinction of being the largest liner built in Great Britain. Her length is 869ft. and her gross tonnage 45,647. The main propelling machinery consists of four Parsons turbines, each driving a propeller direct. The turbines, one high, one intermediate, and two low pressure, develop a total force of 60,000 H.P., and give the vessel a regular sea speed of 23½ knots. Steam at 200 lb. pressure is supplied by 21 double-ended cylindrical boilers, each with eight furnaces fitted for oil fuel burning on the White system. Four direct-current turbo-generators supply electricity at 220 volts for power and 110 volts for lighting throughout the ship.

SOUTHAMPTON WATERWORKS.

As an alternative to the inspection of the "Aquitania" a party visited the Borough of Southampton Waterworks, under the guidance of Mr. E. C. Rodda, the waterworks engineer. The waterworks are situated at Otterbourne, about halfway between Southampton and Winchester. Until 1803 the town's water supply was derived from wells, some of which dated from 1290. From 1804 to 1852 the supply was derived from reservoirs on the Common. Subsequently a supply was obtained from the river Itchen, at Mansbridge, but in 1884 that supply was abandoned in favour of one derived from wells sunk in the chalk at Otterbourne. These works were completed in 1888. The pumping equipment originally installed consisted of two compound beam engines, running at 18 r.p.m., each capable of pumping 2 million gallons per twenty-four hours against a combined lift and head of 220ft. A covered reservoir at Otterbourne Hill supplied the water to the town through a 24in. pumping main and a 16in. gravitation main. In 1896 and in 1901 a third and a fourth engine were installed. In 1921 the Corporation acquired the undertaking of the South Hants Water Company, and now supplies water to a population of 247,000 residing in an area of 220 square miles. Recently the Otterbourne pumping station has been extended by the sinking of two additional wells, and the installation of two vertical triple-expansion Worthington-Simpson engines, each capable of delivering 6 million gallons per twenty-four hours against 280ft.

PORTSMOUTH AND H.M.S. BARHAM.

On Friday, June 29th, the visitors proceeded either by water or by road to Portsmouth. In the forenoon, while some inspected the Portsmouth main drainage pumping station at Eastney, the Portsmouth electricity works, the Havant Works of the Portsmouth Waterworks Company, or the Hilsea Works of the Portsmouth Gas Company, another party was shown over H.M.S. "Barham," under the guidance of the ship's officers. The "Barham" is a battleship of the "Queen Elizabeth" class and was completed at Clydebank in October, 1915. She has a length of 600ft. and a normal displacement of 27,500 tons. Her propelling machinery consists of Brown-Curtis turbines having a designed aggregate horse-power of 75,000. Steam is supplied from twenty-four oil-fired Yarrow boilers. The oil stowage capacity is 3400 tons. The ship carries eight 15in., twelve 6in., and a number of high-angle and small guns, and is equipped with four 21in. submerged torpedo tubes. She was present as part of the Grand Fleet at the Battle of Jutland and is now being refitted for service in the Mediterranean.

PORTSMOUTH DOCKYARD.

Following luncheon in the Guildhall, the visitors proceeded to Portsmouth Dockyard, through which they were conducted by the dockyard officials. This visit also included an inspection of the dockyard museum and of H.M.S. "Victory."

Portsmouth Dockyard has been established for at least 700 years. Its first dry dock was begun in 1495. This dock could accommodate a vessel of 600 tons. It was filled up in 1623. In 1649, during the Dutch War, the number of shipwrights employed at the dockyard was not more than a hundred. They were assisted by one team of horses. In the eighteenth century much progress was made, and in 1835 the "Hermes," the first steam vessel, was built. The introduction of steam in the Navy called for increased accommodation, and in 1843 eighteen acres were acquired for the construction of a 7-acre steam basin, four docks and several large buildings. In 1864 the area of the yard was 110 acres, but in that year extensions were begun which increased the area by 150 per cent. Within the last few years further extensive alterations have been made. The visitors were particularly interested in seeing at work the original block-making machinery designed in 1801 by the elder Brunel. They also inspected with interest the semaphore tower and rigging house now being reconstructed on the South Railway Jetty, after having been destroyed by fire in 1913. The semaphore tower, before the introduction of the electric telegraph, was in use in conjunction with a chain of similar towers on the hills between Portsmouth and London as a means of communication between the dockyard and the Admiralty. A message could be transmitted in half-an-hour, while the daily time signal from Greenwich could be transmitted in half-a-minute. The last message to be sent by semaphore was despatched on December 31st, 1847.

AN AMERICAN PIANO-WIRE LABORATORY.

IN spite of radio concerts and other modern competitors, the manufacturers of pianos in America find that there is a steady demand for high quality and improved instruments. To assist in meeting this demand and competition an acoustic laboratory for testing the behaviour of piano wire under stress has been established by the American Wire Company. The equipment is interesting. One instrument, which makes the sound waves visible, has a microphone to pick up the sound, convert the vibrations into electric impulses and step them up in an amplifier. The vibrating current operates in a magnetic field across which is a mirror; two fine wires in this field vibrate with the impulses and their movements are followed by a beam of light thrown upon the mirror. All musical notes from the base tone of twenty-seven vibrations to the high treble of 4200 vibrations can be visualised and recorded in this way. Another instrument is the monochord, having a sound board with a movable bridge, so that a wire of any length up to 7ft. can be set, and then struck by a hammer and key, as in a piano. Many problems in piano design are being submitted to the laboratory by manufacturers. It is often desirable to re-design the lengths and leadings of the wires and to vary the points at which they are struck by the hammers, while some cases involve complete re-design of the scale or acoustic stringing of a piano or other stringed musical instrument.

Obituary.

SIR JOHN I. THORNYCROFT.

THE professions of engineering and naval architecture, alike, have suffered a severe loss by the death of Sir John Thornycroft, which took place at his Isle of Wight home, Steyne, near Bembridge, on Thursday, June 28th.

John Isaac Thornycroft was born in Rome on February 1st, 1843. He was therefore well on in his eighty-sixth year at the time of his death. His father, Thomas, and his mother, Mary, were both of them sculptors, and it was for the purpose of studying the statues at the Vatican that they had visited Rome, where their elder son was born. Thomas Thornycroft, in addition to being a sculptor of more than ordinary note—one of his best known works is the group depicting Boadicea and her daughters, which is at the end of the Victoria Embankment facing the Houses of Parliament—was a mechanic of no mean skill, and it was in his private workshop that young John, who inherited his father's bent in this direction in a marked degree, got his first insight into things mechanical. Whence he imbibed his intense love for boats of all kinds we do not know, but certain it is that at a very early age he gave evidence of possessing it.

John Thornycroft received his early education at a private school and thereafter passed through Glasgow University, where he had the advantage of studying under Sir William Thomson, afterwards Lord Kelvin, and Professor Macquorn Rankine. His indebtedness to both he frequently acknowledged in after life. After completing his course at Glasgow he spent some time in shipyards in the North, including that of Messrs. Palmer's at Jarrow, and then returned to London, where, at Chiswick, he laid the foundations of what was destined to become one of the most famous shipbuilding businesses in the country.

As quite a lad he had built a small model boat, which he named the "Annie," and which was fitted with a closed stokehold and a fan to furnish forced draught. When only seventeen years of age he designed and built a canal launch which had a length of 36ft. and a beam of 5ft. 10in. She was an iron-built, steam-driven vessel, to which her builder gave the name of "Nautilus," and it is reported of her that she could easily outpace the swiftest racing eights on the Thames, which is equivalent to saying that her speed must have been in excess of 12 miles per hour. With such constructions to his credit it is no wonder that the youth, even at that early age, had determined upon his career; he would be a builder of high-speed craft for river work. It is not to be supposed, we think, that, at the outset, he had any idea of undertaking naval work, and yet, when he did branch out in that direction, the structures that he built differed but little from those he had previously designed. But this is anticipating.

The Chiswick yard was started in the year 1866, when its founder was in his twenty-fourth year. It was built on land which had been given to him by his father, on the Middlesex bank of the Thames between Chiswick Church and the river. From small beginnings it developed eventually into a long rambling place, which extended up river as the business grew. The length of the yard may be judged by the fact that the main line of shafting twisted at least one-third of a revolution at the driving end before the distant end began to move. Of this fact we can vouch from personal observation. According to all accounts, the fast steam launches which he designed and built very speedily attracted attention, and orders flowed in quickly, and bigger and more powerful craft were successively designed and constructed. One of his earliest productions was the steam launch "Miranda," which was about 60ft. in length and was used for following the University Boat Race. She was constructed in 1871 and was noteworthy in several respects. First, she was built of steel, which was a new departure for launches. Then, again, she was fitted with a compound engine, in which, we believe for the first time, cast iron columns were replaced by turned steel columns for the sake of lightness. The boiler was of the locomotive type. With this vessel the then unprecedented speed of over 18¾ miles per hour was attained. She was experimented with by the late Mr. (afterwards Sir) Frederick J. Bramwell, about the year 1872, and he, some years afterwards, said of her:—"That boat gave results which up to that time were entirely unknown, results which it had been stated by high authorities on naval architecture could not possibly be attained. In fact it was well known that one gentleman had said a boat under a given length could not be propelled beyond a certain rate by engine power at all, without a cost so excessive that it would be cheaper to carry it on men's shoulders." Mr. Thornycroft, by the construction of the "Miranda," "showed that those statements were inaccurate, and that it was possible, by a judicious construction of the hull and a due proportionment of engine and boiler power, and by having regard to the weight of the structure, to attain speeds which had previously been thought to be with vessels of the size with which the author—(Sir John)—was then dealing, beyond the range of possibility." It is of interest to record that with her engine running at 200 revolutions per minute the "Miranda" attained a speed of 7 miles per hour; at 300, nearly 10; at 400, nearly 12; at 500, 16¾; and at 550, 18¾ miles per hour. At 200 revolutions per minute the engine developed 4 horse-power, and at 600 revolutions 71 horse-power. The engine, it may be mentioned, was non-condensing.

The successful results obtained with this vessel firmly established Thornycroft's reputation. Orders continued to flow in. The Norwegian Government was among the earliest to take advantage of these high-speed boats, and ordered a vessel which was 57ft. long and carried a spar torpedo. Among other commissions which Thornycroft received was one to build a yacht for use on the Lake of Geneva from the Baroness Rothschild. The "Gitana," as she was called, was in her way as epoch-making as had been the "Miranda." Her length on the water line was 86ft. and extreme length 90ft. The beam at the water line was 10ft. 6in., and her extreme beam 13ft. 2in. She drew 4ft. aft and 1ft. 1½in. forward and she had a displacement of about 29 tons. The engines were compound, condensing by injection, with an intermediate receiver. There were three cylinders, one high-pressure, 13½in. diameter, and two low-pressure, each 15in. in diameter. The stroke of all was 16in. and they worked on three cranks placed at equal angles. The propeller was three-bladed, 5ft. 3in. in diameter, with a pitch of 8ft. 6in. The boiler was of the locomotive type, the working pressure being 120 lb. per square inch. The engines developed 460 I.H.P. at 320 revolutions per minute and we understand that a speed of very nearly 24 miles per hour was attained by the vessel on her trials.

From the "Gitana" to the torpedo boat was no great step. The first torpedo boat ordered by the British Government—the "Lightning," which was built some three or four years after the "Gitana"—was almost identical with that vessel, with the addition of torpedo discharging equipment. The "Lightning" had a speed on trial of 18·55 knots.

With the space at our disposal it would be quite impossible to enumerate in full the succession of war vessels of this type which John Thornycroft evolved as time went on. Larger in size they became, and speedier, and more and more perfectly equipped for their intended work. Then there came the destroyers. Always there was the struggle to obtain the largest amount of power and the highest speeds out of the least weight of metal. How great was the success achieved may be gauged from the fact that the latest Thornycroft destroyers to be built attained a speed of 40 knots and more.

In achieving this result the use of the water-tube boiler played a leading part. In stepping up from the "Miranda" and the early torpedo boats to something larger it was soon found that the locomotive boiler, with which those vessels were equipped, was not capable of providing enough steam to fulfil the weight-power ratio aimed at. Although every effort of the constructor was used to increase the steaming capacity of those boilers, so as to make them comparable in service with locomotive boilers on the railways, it was ultimately decided that, notwithstanding the amount of heating surface provided in a locomotive boiler working afloat, a comparable performance could not be attained on shipboard on account of the lesser vibration there experienced. It had been established that it was the vibration which, by disengaging the steam bubbles, kept the heating surfaces free for evaporation purposes.

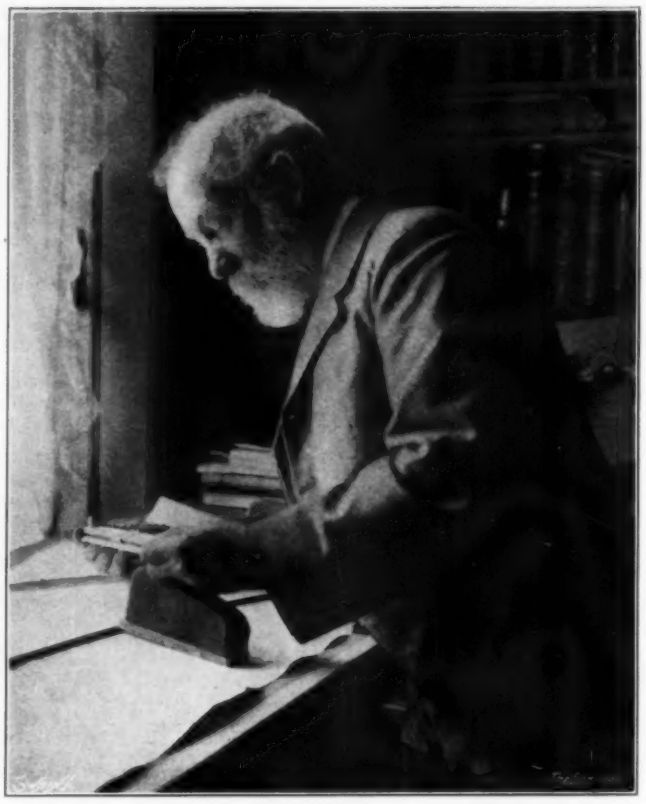
So the opportunity arrived for the real advent of the water-tube boiler for marine purposes. Its merits had been indicated by other inventors, but Thornycroft struck out in a rather novel direction in insisting on a closed circuit of circulation, with steam generating tubes discharging their contents above the water line in the top drum and "downcomers" deliberately put outside the boiler casing, so that they would be cooler than the generating tubes and consequently induce a downflow of the water which had not been evaporated. Thornycroft, as opposed to the school which maintained that the essential aim must be to crowd as large a heating surface as possible into a given space, contended that that alone would not bring about the desired result, and insisted that a perfect circulation of the water in the boiler was the chief object to be sought.

We well remember witnessing some tests with an experimental boiler at Chiswick, which had a glass end to the steam drum and a V notch between the end of the bank of generating tubes and the downcomer. It was obvious that there was a definite flow of water up the tubes and down the downcomer. Nevertheless, experience at the Chiswick yard and elsewhere showed that such preparations for a definite circulation were unnecessary and the more modern form of Thornycroft boiler was evolved. Fanciful bends in the tubes were dispensed with and the downcomer in the stokehold was eliminated, to the joy of the stokers.

The first warship to be fitted with Thornycroft boilers and, indeed, the first vessel, we believe, in the British Navy to be equipped with water-tube boilers, was the torpedo gunboat "Speedy," and she was eminently successful. Up to the time she was so fitted boilers of the locomotive type only had been used. At the present moment we gather that the output of Thornycroft boilers built under licence at home and abroad approaches 2½ million horse-power.

It is difficult, in a case like the present, to differentiate between the founder of a firm and the firm itself. The life of Sir John Thornycroft is so bound up with that of his company that it is almost impossible to draw a line between the two. So, for the moment, we turn to the firm itself. In 1872 Sir John's brother-in-law, Mr. John Donaldson, who had been a fellow student with him at Glasgow University, joined him as a partner in business, and the two worked most harmoniously together. The partnership lasted until 1900, when Mr. Donaldson died. The business, which had until that time been carried on as a private undertaking, was then converted into a limited liability company.

As the size of the craft built at Chiswick increased it became continually more and more difficult to get them down the river past the bridges to the sea. At length matters came to such a pass that deck works had to be removed before the vessels could be taken downstream. Then it was that it was decided that



SIR JOHN ISAAC THORNYCROFT

a move must be made to a position which would free the company from this disability, and Sir John fixed upon Woolston, Southampton, for the new home. There, there happened to be available a shipbuilding yard which had for some time been used for building fairly large commercial vessels and for ship repair work, and the business was transferred from Chiswick to it.

Just about the time when the move was made, the Committee which had been appointed by Lord Fisher to report on new designs for warships and the most suitable machinery for naval purposes, and of which Committee Sir John was a member, decided that the turbine was superior to reciprocating machinery for the special conditions required. Accordingly it was necessary to provide a class of plant quite different from that existing in the Woolston works when they were acquired, and the opportunity was taken of thoroughly equipping those works with machine tools of a type suitable for turbine construction. With the more extensive yard and facilities the work of the firm became of a much wider range. In addition to the torpedo craft and shallow-draught river steamers which had, up till then, alone been constructed, the building of all classes of moderate-sized high-speed vessels was undertaken, the vessels being built, engined and entirely completed in the one establishment. There, too, extensive repair work on vessels of all classes, including the largest Atlantic liners, could be and was effected.

It may here be said that, though Sir John Thornycroft and his partner Mr. Donaldson took the keenest personal interest in all the work carried out by the firm, they were careful to look to the future. Both of Sir John's sons—Sir John E. Thornycroft and Mr. T. Thornycroft—and Mr. Donaldson's eldest son were trained as engineers and they, together with leading members of the staff, have become technical directors and departmental managers of the present business.

It might have been thought, perhaps, that Sir John would have found his time and his activities fully taken up in attending to the operations of his shipyard. But in the very early days of motor vehicles he foresaw the important part which they were destined to play in the future. Accordingly he began experimenting in a shed at Chiswick which had originally been used by his father and brother as a statuary studio, and there, subsequently, the construction of self-propelled carriages was undertaken. Sir John's knowledge of light high-speed engines stood him in good stead at this juncture. The first vehicles produced were steam driven. The very first was a front-driven car, which was first put on the road in the early hours of the first day of the "emancipation," when the red flag which, till then, had to be carried in front of each self-propelled road vehicle—road rollers, for example—was done away with. The vehicle had a Thornycroft water-tube boiler, a Willans compound launch engine, and a chain drive. This machine, which had the distinction of being the first to run under the new legislation, is, we believe, still in existence. It was followed by other "steamers," some of which were supplied to the Westminster City Council and are, or quite recently were, still in service. Very soon, however, the advantages possessed by the internal combustion engine decided him to employ that type of motive power, and eventually the Thornycroft self-propelled lorry, which is known throughout the world, was evolved. For its manufacture a separate establishment was built at Basingstoke. Originally the motor vehicle business was carried out by the Steam Carriage and Wagon Company, Ltd., but when the move to Southampton was made it was deemed convenient to have all interests combined under one management and the firm of John I. Thornycroft and Co., Ltd., controls both the Southampton and Basingstoke businesses. In developing the lorry Sir John devised many improvements, and he certainly managed to evolve a most serviceable vehicle which during the war and at other times has shown itself capable of operating successfully under adverse circumstances.

After this necessarily brief survey of Sir John's business life as a whole, we may pass on to particulars. Actually it might well be said of him that his life's history can be read at the Patent Office. Between the years 1873 and 1924, a period of just over half a century, he himself took out between fifty and sixty patents, and his name was associated either with those of one or other or both of his sons or with that of the companies which he founded in very many more. The patents were for a diversity of subjects. The first to which attention may be directed was taken out in 1873 and was for a screw propeller. It was designed to counteract the centrifugal tendency of the water which—to use the words of the specification—"it drives backward in what may be termed hollow cylinders or concentric annular volumes." To effect this object each blade was curved in the direction of its length in such a manner that, assuming the blade to be cut in a plane passing through the axis of the propeller, and through the centre of the blade in a direction parallel to that axis, the section of the blade was convex on its driving face, on its driving or rearward surface. The difference in shape between an ordinary propeller and one of the Thornycroft type has been likened to that between a perfectly shaped woman's hand and that of an old man crippled by rheumatism. This propeller as finally developed was a great success.

Another invention made in the following year enabled self-propelled vessels to be made of shallower draught than had up to then been possible. This result was achieved by arranging the propeller in a chamber formed in the rear of the underside of the vessel, the chamber converging from a bell shape, in plan, forward, to a parallel passage aft in which the propeller was arranged. Immediately above the propeller the roof of the passage was curved up well above the water line, so that what was virtually a domed tunnel, into which air could not enter, was formed. The blades of the propeller, when the vessel was at rest, reached above the water line, but, when the screw was revolved, what air there might be in the cavity formed by the dome was driven out and the propeller revolved in solid water. This arrangement was employed with excellent results in very many shallow-river craft.

Very early in his career Sir John realised the importance of reducing the skin friction of vessels intended for high speeds. His first invention in this direction was patented in 1877. His proposal was to form an external cavity in the bottom of the boat and to arrange what was virtually a perforated pipe at the fore end of this cavity. Compressed air was blown through the perforations in the pipe, and, displacing the water in the cavity, reduced the friction on the underside of the hull of the vessel. A further development of this system was patented in 1908, while in 1909 there was a further patent which specifically claimed that by giving a special form to the bottom of a vessel her bow would tend to rise out of the water when the craft was in motion and that skin friction would in that way be reduced. This matter has considerable bearing on the development of the coastal motor boat, to which we refer later.

About the time that the "Lightning" was built Sir John devised a method for launching "fish" torpedoes—such as the Whitehead—from the sides of vessels. The arrangement employed was very similar in idea to that of ships' davits. Almost at the same time he took out a patent for removing moisture from the windows of conning towers by means of absorbent pads operated by hand levers, and in the same year he evolved a new type of steering apparatus. It embodied a rudder or paddle movable on a joint, which could be given—by an engine or motor—a sculling movement and was capable of being reversed. This paddle could also assume positions in which its surface was inclined to the vessel's course, as an ordinary rudder. Another invention having to do with the propelling and steering of vessels was patented in 1879. In this case the propeller was surrounded by a tube or casing, and the object was so to arrange matters that the cross sectional area of the stream of water set in motion by the propeller should be caused to diminish during the action of the propeller. Several other patents having to do with the steering of vessels were also taken out at different periods.

The year 1882 marks an epoch, for then was taken out the first of a series of patents which resulted in the evolution of the present Thornycroft boiler. In one of its earlier forms the boiler comprised drums connected by two banks of tubes curved from the water drums so as to form an arch over the combustion chamber and then taken back round to the upper portions of the steam drum, which they joined above the water line. It was such a boiler that was fitted to the "Speedy" in 1885. It is said that, in the space available, one thousand more horse-power could be developed than with the previously used locomotive type boiler. Considerations of space preclude us from specifying in detail the various phases through which the boiler passed before it reached its final forms. It must suffice to say that two of the forms devised were called the "Daring" and the "Tartar" types, by reason of the vessels in which they were first fitted, and that patents in connection with them were taken out in 1885, 1894, 1896, and 1899 (two).

In 1885 a patent was taken out for employing compressed air for transmitting signals or orders on board ship, the arrangement being also applicable to the indication of the speed or direction of motion of engines. A development of the device was patented two years later.

In 1889 a patent was taken out for preventing or lessening the rolling of vessels at sea. It is out of the question for us in a memoir such as this to attempt to describe the somewhat complicated proposals which formed the subject of this invention. It may be said, however, that it was sought to achieve the object aimed at (1) by balancing the turning moment or forces tending to make the vessel place her masts at right angles to a wave; (2) by maintaining the vessel's stability; and (3) by offering resistance to any rolling motion she might from any cause attain. The means employed comprised two levers, one short and one long, pivoted weights, and adjustable blades or bilge keels.

Of the patents taken out for steam engines mention may be made of No. 13,439 of 1893, the grant of which was, in the first instance, opposed. The engine had four cylinders, arranged in pairs, working on to four cranks on a shaft carried by four bearings. The two cranks for each pair of cylinders were juxtaposed and connected by a common arm without intervening bearing, two bearings coming between the two pairs of cranks. The two cranks forming each pair were arranged at such an angle that, when one piston was at the end of its inward stroke the other was at the end of its outward stroke, and a projection of the axis of either piston-rod would pass through the axes of its crank pin and of the shaft. It was claimed for the arrangement that by means of it the weight of any engine might be appreciably reduced without diminution of strength, and that the weight upon the main bearings, due to the pressure of the piston, and also the vibration of the engine were very greatly reduced.

As long ago as 1918 Sir John turned his attention to the extraction of juice from vegetable substances—particularly juice containing sugar from soft vegetable substances, such as beet. He took out a patent in that year for an apparatus for this purpose, and a further patent was taken out in 1921 and still another in 1923. It will be observed that Sir John was among the earliest in this country to interest himself in home-grown sugar.

As showing the multifarious nature of Sir John's activities we may say that, at one time or another, patents, in addition to those already mentioned, were taken out for a means of preventing injuries to stokers in the event of burst boiler tubes; improvements in oil feeders or apparatus for supplying lubricant to steam engines and other machines; feed water regulators; steam traps; air-cooled condensers; stuffing-boxes; carburetters; spraying apparatus for liquid fuels; variable-pitch propellers; means for driving models in experimental tanks; valve operating mechanisms; a method of making observations from aircraft in which the use of prisms was employed so that the horizon might be viewed at the same moment as the object beneath the aircraft; a vessel provided with launching troughs for torpedoes and explosive mines; improvements in helical propellers; a wind motor; door fastenings; an improved propeller which is intended, ordinarily, to operate semi-immersed, etc.

At his own expense Sir John built at his Isle of Wight home an experimental tank, by means of which he carried out many experiments on hull forms, which resulted, among other things, in the taking out of the patents of which mention has already been made. The experience gained with this tank was also of the utmost service in the design of the coastal motor boats, which were built by his firm during the war and which performed signal service in combatting the submarine menace.

In character Sir John was what might be described as a fatherly man, and his face inspired confidence at first sight. He was always thoughtful of his sons, and on special occasions, such as trial trips, the boys were allowed on board so that they might gain experience to fit them for their prospective careers. Guests, too, who had attended those trials, were entertained in the evening in his family circle. At the same time he was a man of determined character, as will have been gathered from what has already been said. A first-class mechanic himself, he was always ready, if things were not going to his liking, to snatch a tool—any tool, he was equally handy with all—from a workman and to show him how to "set about a job." Then, again, when it might have been thought that his time was fully occupied with the construction of high-speed destroyers and similar craft, he supervised the sinking of a deep well on his Steyn estate and engineered the extermination of what was a veritable plague of black beetles in his house there! It was characteristic of the man that, at the annual house parties which he delighted to give, some new invention was displayed in such a manner that it appealed equally to the non-technical and to the technical among his guests. To give one example: on one occasion a fountain, which was operated by a high-speed propeller, was so arranged in a glass tank that light from an arc lamp—one of a very early type—below shone up through the water. The current for working the lamp was obtained from one of the earliest of private electric generating plants which was gas driven.

Sir John Thornycroft contributed numerous papers to the Engineering Societies to which he belonged and to the British Association. In his younger days, too, he frequently took part in the discussion of the papers of others, nearly always having something useful to say. He was admitted to the Institution of Civil Engineers as an associate member in January, 1873, and was transferred to the class of member in November, 1877. For a period he served on the Council. During his membership he was awarded a Watt Medal, a George Stephenson Medal and a Trevithick Premium. A paper which he read in 1881 "On Torpedo Boats and Light Yachts for High-speed Steam Navigation" created a tremendous sensation, bringing to light, as it did, performances of fast steam-propelled vessels which were at that time by no means widely known. The reading and discussion of the paper took up no less than three sessions of the Institution, and among those who took part in the discussion were Mr. (now Sir) A. F. Yarrow, Admiral Selwyn, Mr. James Wright—Engineer-in-Chief of the Navy—Mr. (afterwards Sir) W. H. White, Mr. J. D'A. Samuda—himself a distinguished boat builder—Mr. (later Sir) Nathaniel Barnaby—the then Director of Naval Construction—Mr. T. R. Crampton, Mr. (afterwards Sir) F. J. Bramwell, Mr. George R. Dunell, Mr. (afterwards Sir) J. F. Flannery, Mr. Walter Hunter, Mr. (later Sir) Benjamin Baker, and Mons. J. A. Normand, of Havre.

Sir John was elected a member of the Institution of

THE LOCHABER HYDRO-ELECTRIC POWER SCHEME

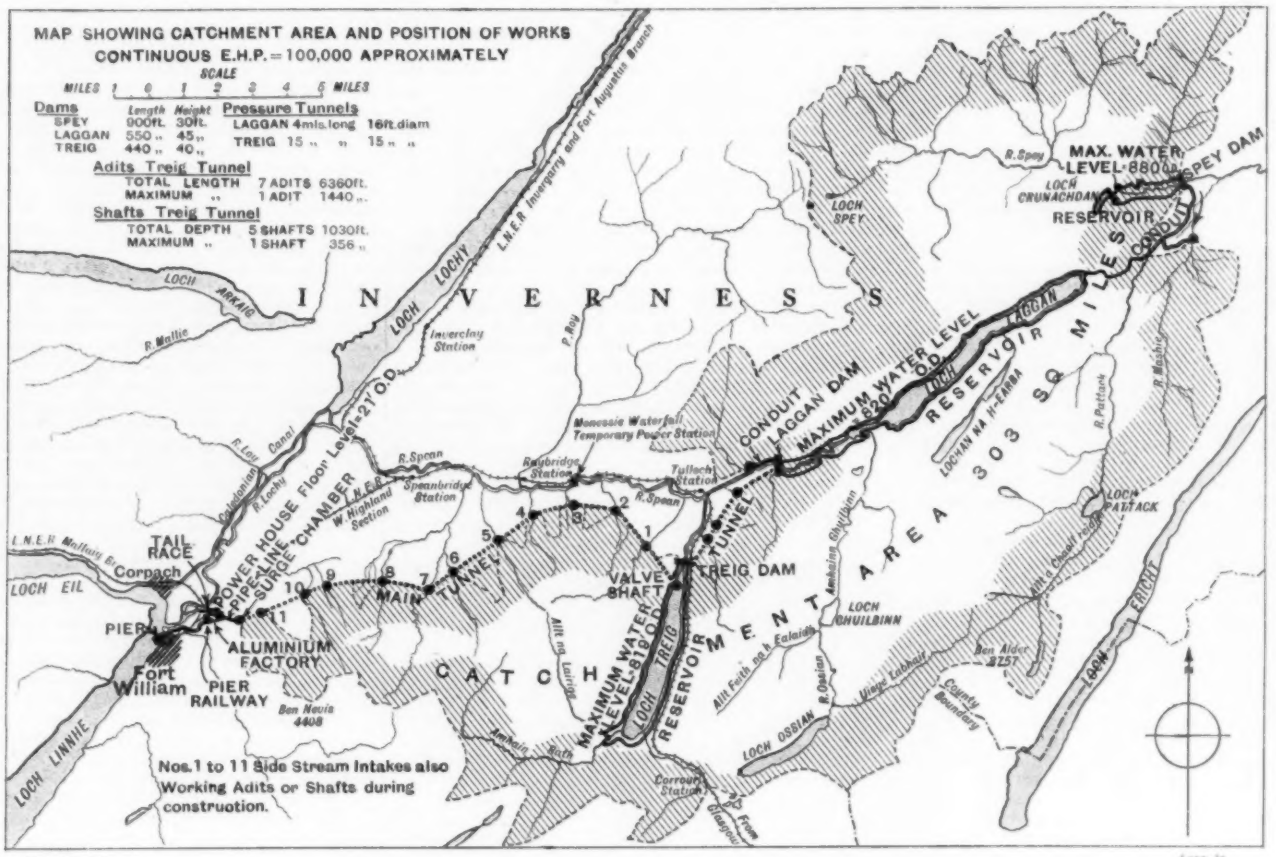


FIG. 12

Mechanical Engineers in 1876, was made a member of Council in 1897, and retired from that office in 1911. He was made an Honorary Life Member of the Institution in 1926, on the fiftieth anniversary of his having become a member.

Of the Institution of Naval Architects he was made member of Council in 1882, a vice-president in 1889, and an honorary vice-president in 1909. He was made a Fellow of the Royal Society in 1893, and received the honorary degree of LL.D. at Glasgow University in 1901. The honour of knighthood was conferred on him in 1902.

Institution of Electrical Engineers.

SUMMER MEETING.

No. II.*

ON Wednesday afternoon, June 27th, some of the members visited the works of Bruce Peebles and Co., Ltd.; others took part in an excursion to Queensferry, the Forth Bridge, and the Deer Park of Hopetoun House, returning to Edinburgh *viâ* Turnhouse Aerodrome and the Scottish Zoological Park. Few engineering establishments are situated in a more desirable spot than the Bruce Peebles works, which stand in open country and face the Firth of Forth. The 10-acre site is accessible by land or sea; it is about half a mile from the docks at Granton and two miles from the Leith Docks, whilst the Leith branch of the London, Midland and Scottish Railway Company's line passes the premises. A siding runs into both ends of the works, thereby facilitating the entry of castings and raw materials at one end and the dispatch of complete machines at the other. Electric locomotives running round and into the works provide a convenient connecting link with the London, Midland and Scottish system.

In 1918 a heavy engineering shop was erected on the west side of the main building for the manufacture of large plant having parts weighing up to 30 tons. This shop stands apart from the works, as planned in the year 1903. The main shop of the original factory is 600ft. long and 150ft. wide. It is encircled by a gallery and is divided into five bays. The centre bay is used for large machining and erection work, for testing, packing and dispatching finished machines. The lighter work is carried out in the side bays and on the galleries. Normally, electric power for driving the works is obtained from the Edinburgh Electricity Department, but there is an emergency 300-kW steam plant consisting of a Belliss and Morcom engine coupled to two dynamos in tandem.

The motor converter remains one of the firm's principal products, notwithstanding that, within recent years, the construction of this type of machine has been taken up by practically all the electrical manufacturers. At the time of the Institution's visit a number of these converters were going through the works, including 1500-volt traction machines for India. Other classes of electrical machinery, such as rotary converters, alternating and direct-current motors and generators are, of course, also manufactured. Moreover, within recent years transformers have been added to Bruce Peebles products, and a very fine transformer shop—see Fig. 13—has been built. The lay-out of this shop facilitates rapid and efficient production; manufactured parts pass forward to the assembly and erection departments with the minimum amount of handling. The progress of all the material through the shop is unidirectional and the production of parts is easily synchronised, making efficient use of floor space. In the core cutting and punching section, machines of modern design ensure accurate dimensions, clean cutting and punching and a high rato of output. After they have been cut and punched and treated to remove scale, the plates are passed through an insulating machine, as shown in Fig. 14, in which they are first coated on one side with an oil-proof insulating material and then subjected to heat treatment. In their passage through the

FIG. 13—INTERIOR OF BRUCE PEEBLES' TRANSFORMER SHOP

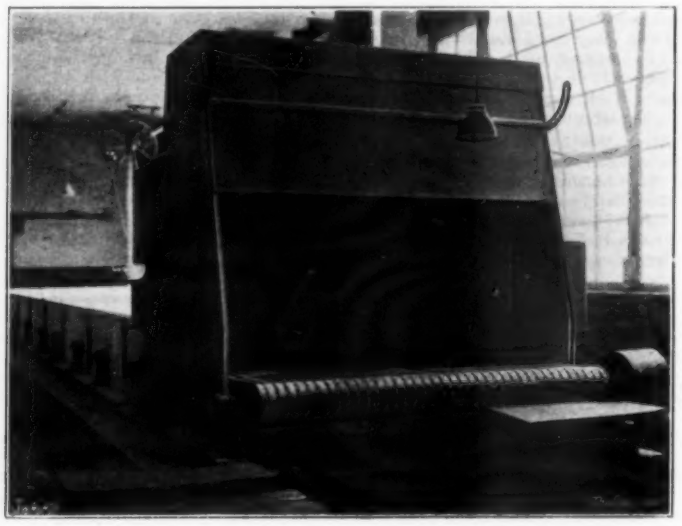


FIG. 14—CORE PLATE INSULATING MACHINE—BRUCE PEEBLES

* No. I. appeared June 29th

machine the plates are carried forward to the core building section. Adjustable tables are employed for assembling the core plates, and on the three-phase interleaved type of core, extra insulation is inserted at definite steps throughout the core with the object of ensuring adequate protection against high losses from circulating currents. When the cores have been finished in this section of the shop they are transferred to the assembly section, where they receive their windings.

In the high-tension coil winding section, winding machines and formers of new design simplify the work and ensure the expeditious production of accurately dimensioned windings. Like the low-tension coil winding machines, those employed for

FIG. 15 PART OF TUNNEL DURING CONSTRUCTION

winding the high-tension coils are of the firm's own design. Multiple-strip conductors are machine taped as they are wound on the former, a process which increases the speed of winding and ensures cleanliness and uniform insulation between the turns. All windings are thoroughly dried under vacuum and then impregnated with a specially prepared hot oil-proof insulating varnish under ample pressure to secure complete penetration. Instruments indicate the degree of vacuum, pressure and temperature during the operation.

The manner in which the process is carried out is claimed to ensure for all time a very high degree of insulation between turns and layers, freedom from sensitiveness to moisture, low temperature gradients with accelerated heat transference from the inside to the surface of the coils, and considerable mechanical strength in the solid block of closely cemented turns and layers. All coils are tested and inspected before grouping for erection on the cores. The thorough testing of all parts at this initial stage in manufacture permits of adjustment, if required, with a minimum amount of inconvenience and delay, and ensures easy erection and freedom from faults in the final stages. Complete sets of parts are transferred from the assembly section to the erecting section as they are ready, and all transformers receive a preliminary test for ratio when they are partly erected. They are then completed and passed on to the drying ovens, which accommodate the largest units complete and effectively dry the cores as well as the windings and insulation. Immediately after they have been dried out, the transformers are fitted in their tanks and immersed in oil. The testing section is equipped with extra H.T. and L.T. transformers, variable frequency motor generators, and high-grade instruments.

On Thursday morning, June 28th, the party left Glasgow by special train for Fort William. A halt was made at Tulloch, where a light luncheon was provided by the British Aluminium Co., Ltd., and Balfour, Beatty and Co., Ltd. Subsequently the works in connection with the Lochaber water power scheme was inspected. The scheme, for which an Act of Parliament was obtained in 1921 and which is the third water power scheme undertaken by the British Aluminium Company, Ltd., in Scotland, was dealt with pretty fully in our issue of March 4th, 1921. When completed the new works will produce more than double the present output of aluminium in Scotland. The company was formed in 1894. It commenced operations in 1896 with a plant at Foyers, on Loch Ness, Inverness-shire, whilst in 1909 the Kinlochleven Works in Argyleshire were brought into operation. The new power-house and factory of the Lochaber scheme will be situated one mile north-east of Fort William. The continuous output of the power plant will be approximately 100,000 horse-power, or three times that of Kinlochleven. The catchment area from which water for power will be derived is 303 square miles. The general outline of the scheme is shown on the map, Fig. 2.

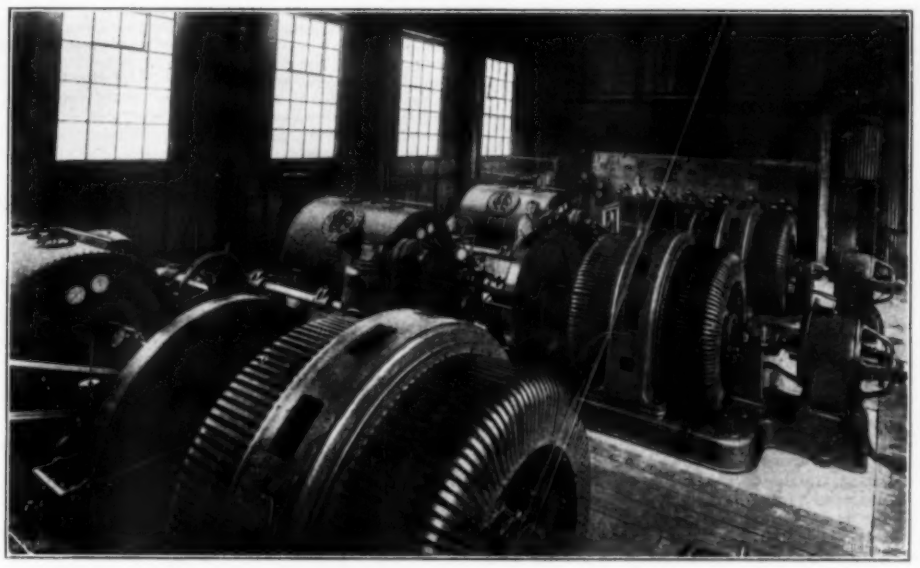


FIG. 18—INTERIOR OF TEMPORARY POWER HOUSE

Between the extremities of the catchment area the rainfall varies considerably; at the western end at the top of Ben Nevis the average rainfall is 160in.; at the northern end of the area, some 33 miles from Ben Nevis, the average is 50in. The works are designed to deal with a flow of 1600 cubic feet per second. Over a fixed amount of 40 million gallons per diem the flood waters of the Spey are to be directed from the Spey to Loch Laggan.

From Loch Treig a pressure tunnel—see Fig. 15—15 miles long is connected to the top of a steel pipe line leading to the power-house, from which the water will pass through a long tail-race to the river Lochy. The river Spey dam, which is to be 30ft. high and 900ft. long, will be 2 miles above Laggan bridges. It will form a reservoir 2 miles long to regulate and divert the flood waters of the river across the watershed to the river Pattack. By means of an intake the river Nashie will also be tapped. The water will be led to the conduit running from the Spey dam to the river Pattack. Lochs Laggan and Treig form the main reservoirs of the scheme. The area of the former will be extended by dredging the present outlet and by constructing a dam some 4 miles downstream in the river Spean, thereby making the total length 10 miles. The Laggan dam will be 500ft. long and 45ft. high. The level of the lock will not be raised, but the water will be drawn down to a maximum depth of 16ft. A third dam 440ft. long is to be built at the outlet of Loch Treig in order to raise the level by 40ft. The intake of the tunnel leading to the power-house is 100ft. below the present water level, and thus allows a variation of 140ft. for storage purposes. Loch Treig is 5 miles long and has an average width of half a mile. A pressure tunnel 4 miles long will connect the two reservoirs; the intervening country being tapped at the streams by means of shafts leading to the tunnel. The combined capacity of the reservoirs will be 9240 million cubic feet.

From Loch Treig a pressure tunnel with a mean diameter of 15ft. will convey the water to a surge chamber near the top of the pipe line, 15 miles distant. To facilitate construction the tunnel follows the general contour of the mountain side. Eleven streams crossing the line of the tunnel are to be tapped and the water is to be passed into it through shafts. Owing to the high rainfall on the area traversed by the tunnel the water collected by the shafts forms an important percentage of the total run-off. At the surge chamber, which is 220ft. deep, the tunnel bifurcates to the top of the pipe line, where two groups of three steel pipes 5ft. 6in. in diameter will lead to the power-house.

The pipe line will be 3200ft. long and will be controlled by automatic valves. In order to take full advantage of the head available, the power-house is being sunk some 40ft. below the ground level and the turbine pits and tail race are being made still deeper. Access to the turbine house will be obtained

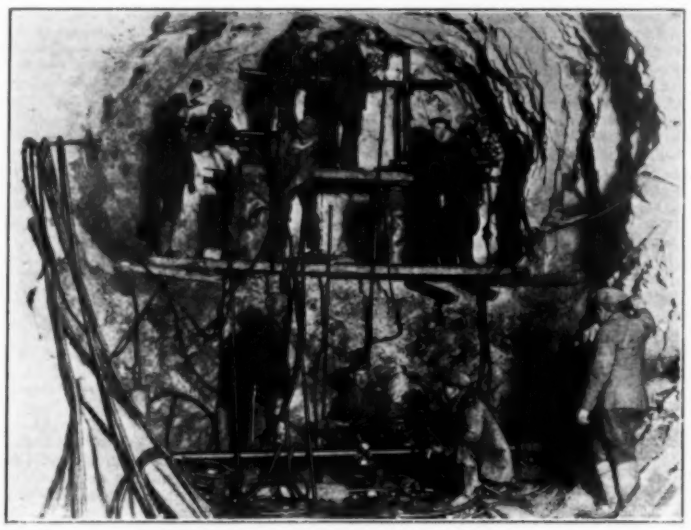


FIG. 16—DRILLING OPERATIONS IN TUNNEL

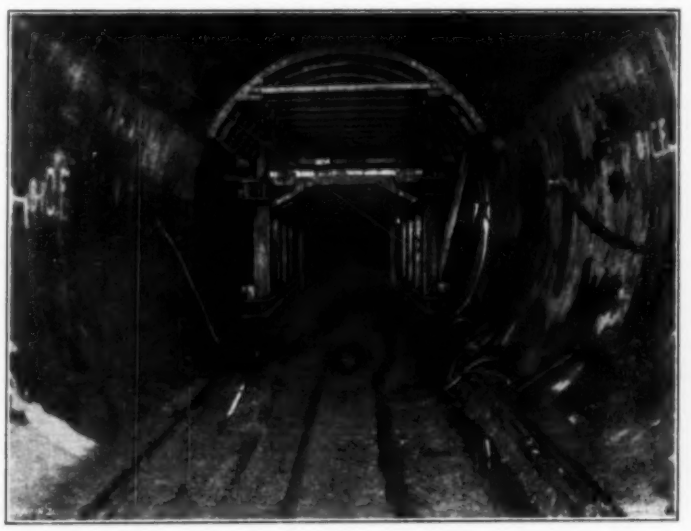


FIG. 17—CONCRETING THE TUNNEL

by means of an incline in rock cutting. The maximum head of the impulse turbines will be 800ft. and the capacity of the generators 120,000 horse-power. The tail-race from the power-house will discharge into the river Lochy below the Mallaig Railway bridge. It will be 3000ft. long, 2000ft. of which will be in open cut and the remainder in tunnel. It will cross the London and North-Eastern Railway twice and the public road once, concrete bridges having been constructed for the purpose.

The extensive aluminium factories will adjoin the power-house and will be situated at a level 34ft. above the power-house floor. They will be served by a railway connected to a reinforced concrete pier which has been constructed at the head of Loch Linnhe with a depth of water alongside sufficient for ocean-going vessels. The main tunnel is being driven from twenty-three faces, eight of which are operated from shafts varying in depth from 200ft. to 356ft and fourteen from horizontal adits varying in length from 420ft. to 1440ft. and one open end at the top of the pipe line. Workmen's camps are situated at each of the shafts and adits with accommodation for over 2000 men, together with recreation huts and hospitals.

Transport is carried out by a narrow-gauge railway running from end to end of the works, a distance of 20 miles. Power for working the tunnel and other machinery is obtained from a temporary power station—see Fig. 18—erected at Monessie, where the head is 100ft. The generators have an output of 5000 horse-power. An 11,000-volt transmission line extends throughout the works and transformers are placed at each point of operation. The method of concreting the tunnel is shown in Fig. 17, whilst Fig. 16 shows the drilling operations at the face. Fig 19 on page 12 shows a general view of the power house foundation work, and Fig. 20 the pipe line.

The Provisional Order for the scheme was initiated by Mr. W. Murray Morrison, director and general manager of the British Aluminium Company, Ltd., and associated companies. The general lay-out of the scheme was due to the late Mr. C. S. Meik, succeeded by Mr. W. T. Halcrow, of C. S. Meik and Buchanan, consulting engineers for the civil engineering works, and with whom Mr. W. J. E. Binnie is associated. The designs of the power plant and factories are being carried out under the direction of Mr. Murray Morrison, Mr. J. S. Bliss, technical manager, and Mr. A. B. Kinnear, architect to the British Aluminium Company. The principal contractors for the civil engineering work are Balfour, Beatty and Co., Ltd.; for the pressure pipe line, the South Durham Steel and Iron Company, Ltd.; for the valves, Glenfield and Kennedy, Ltd.; and for the gates, Ransomes and Rapier, Ltd. The English Electric Company is supplying all the main turbines and generators, and the Metropolitan-Vickers Company and Boving and Co. the subsidiary turbines and generating plant.

After the works had been inspected the party resumed its journey to Fort William. In the evening there was a dance and entertainment at the Highland Hotel, by invitation of the British Aluminium Company and Balfour, Beatty and Co., Ltd. On the following morning, Friday, June 29th, the party left Fort William by steamer for a sail on the Western Seas. The boat arrived at Oban somewhat before 5 p.m., and a few of the party then made their way home. Officially, however, the meeting did not terminate until the following morning.

B.E.S.A. Specifications.

DERRICK CRANES.

THE British Engineering Standards Association has just issued a British Standard Specification for the Scotch Derrick or "Stiff Legged" Guy Derrick, and Tower Derrick types of Cranes used in building operations. This specification has been prepared at the request of the Home Office by a Committee representative of both the buying and manufacturing interests, which has been assisted in its work by consulting engineers, Government officers and others. A perusal of the specification shows that the Committee in preparing it has carefully avoided including anything likely in any way to hinder design, and has endeavoured to set up a standard in which only the performance of the crane and the essentials of its design are dealt with, while the materials used in the construction of the crane are specified in full. It is hoped that the adoption of this specification by users will go a long way towards preventing crane accidents owing to defects in design and to the use of faulty material in their construction.

ROUND STRAND STEEL WIRE ROPES FOR LIFTS AND HOISTS.

THE British Engineering Standards Association has also issued a British Standard Specification for Round Strand Steel Wire Ropes for use with cage or platform hoists or lifts working in guides and used for the hoisting of either passengers or goods. The specification is not intended, however, to apply to ropes for coal hoists or such appliances. This specification has been prepared by Committees representative of both buying and manufacturing interests, and it will, as in the case of all British Standard Specifications, be reviewed as experience of its working or progress in the industry renders it necessary, and revised issues published from time to time. It is intended to provide for wire ropes having six round strands of either 12, 19, or 24 wires per strand, and of both Ordinary and Lang's Lay. Recommendations are included in the form of a Foreword for the guidance of designers and users, and it is hoped that these will be of value and that their use will insure reasonable endurance in service of wire ropes of the types and kinds covered by the specification. Specifications for Oil Well Ropes and for Colliery Haulage Ropes are also in hand by the Committees, and will be published when they are completed.

TARS FOR ROAD PURPOSES.

FOR a considerable time no British Standards for Road Tars have been in existence, those first issued in 1916 having been withdrawn when the Ministry of Transport published its specifications, which were a revision of the original Road Board Specifications. Recently the Ministry of Transport brought to the notice of the Association the desirability of remedying this position, and recognising as British Standards the specifications officially adopted by the Ministry and with which all local authorities are familiar. The proposal was referred to the appropriate technical Committee of the B.E.S.A., and Specification No. 76, Part I., 1928, for Tars (Nos. 1 and 2) for Road Purposes, is the outcome. It contains the Specifications Nos. 3 (*a*) and 3 (*b*) of the Roads Department of the Ministry of Transport issued as British Standards.

CHEMICAL LEAD.

This Specification—No. 334, 1928—is intended to cover primarily lead for sulphuric acid chambers and similar purposes. There are important difficulties in ensuring the suitability of lead for chemical plant, and the Committee recognising that chemical analysis alone can finally establish chemical quality, recommends the use of the Flash and Aqua Regia tests. The methods are fully described, and the results secured by five different authorities by these methods are given.

REGULUS METAL.

Regulus metal is an alloy of lead and antimony, the percentage of the latter ranging from 6 to 12 per cent. according to the nature of the purpose to which the alloy is to be put. The Specification, No. 335, 1928, defines the standards of quality and the means of testing the material.

Copies of any one of these specifications can be obtained from the B.E.S.A. Publications Department, 28, Victoria-street, London, S.W. 1, price 2s. 2d. post free.

Reclamation by Dredger in an Enclosed Area.*

By HARRY CHARLES WESTON, B.Sc., Assoc. M. Inst. C.E.

THE Zanzibar harbour scheme—see the accompanying illustration—comprises a reinforced concrete wharf 800ft. long backed by a Customs area bounded by rubble slopes and mass-concrete retaining walls founded on coral rubble banks. This area, 15 acres in extent, was to be reclaimed both by tipping from the land and also by a sand-pump dredger with an output of 30 cubic yards of reclamation per pumping hour. The dredger operated mainly on a shallow basin north-east of the Customs area. The filling from the land was local red earth formed by the decomposition of coral. It is a mixture of fine sand and red clayey earth which bakes very hard in the sun to a depth of 18in., but below this remains very loose. Consequently this earth could not be used behind the walls or slopes, and, in any case, not in the tidal range. There is a 15ft. range of tide at springs and 4ft. to 5ft. at neaps.

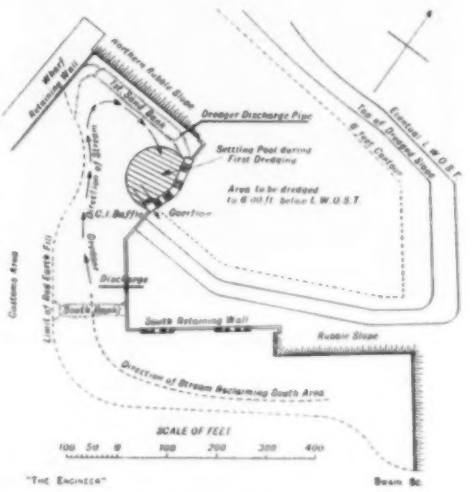
The area to be dredged consisted of sand, very fine mud, and 3in. of poor clay, so that the material discharged by the dredger was not all suitable as backing to the walls and slopes. To seal the rubble slopes in the first instance the dredger discharge-pipe was taken through the north rubble slope which had been built up to El. 9·00ft. The general level of the finished copings of walls and slopes and of the reclamation was to be El. 17·50. By pumping during the top half of the tide a bank was raised up to El. 9·00, and after each day's dredging a sand-bank was formed by hand up to El. 16·00 inside the north rubble slope. The dredger discharge was then kept to the south of this sand-bank, and as the discharge stream had a free outlet, the mud and light constituents were not retained. When this bank was 30ft. wide at the top, it was joined to the retaining wall behind the wharf and also to the walls of the inner basin which were under construction.

The discharge pipe was then taken through the east retaining wall 400ft. south of the previous banks formed, and at El. 9·00. The ground level behind this wall ranged from El. 2·00 to about 6·00 where the sand from the excavation of the wall foundation trenches had been placed. By pumping when this was under water a bank of clean sand was formed immediately in front of the discharge. This sand-bank was thrown up by hand to form a sealing bank south of the discharge outlet, and lengthened to reach the red-earth south fill.

When this was completed the whole of the area north of this bank was enclosed, and an overflow was provided through the retaining wall at El. 9·00. To protect this overflow from the direct action of the discharge stream, a baffle of corrugated iron, on vertical timbers, was constructed about 30ft. south of the overflow and running east and west. The discharge pipe was led 50ft. along inside the wall so that the discharge passed round the sides of the area to be reclaimed. At the overflow the ground level was at low water level so that at all states of the tide there was a settling-pool for the deposition of materials.

It was found that the deposit action changed. Previously with a free outlet the reclaimed bank contained only clean sand, because the silt-cloud travelled out through the rubble slopes. After the change, however, the heavier materials were deposited near the discharge outlet and, as the stream force decreased, the finer materials fell until in the pool near the overflow clean water only passed. As a result after one day's pumping up to 3in. of silt and mud were deposited in and near the settling pool. As pumping continued it was found that near the outlet where the heavier materials fell and the stream force was strong there was no silt or clay in the deposit, but as the stream lost its force the heavier sand tended to overlay the mud. In order to conserve the stream force a corrugated iron apron 30ft. long was clamped round the end of the discharge pipe to increase the "throw" of the jet, because without this the jet formed a large crater from which the stream overflowed. Also pieces of corrugated iron were bent into a ridge shape, and the stream was trained between them to any part of the enclosed area where deposition was required.

When the stream was led to the wharf retaining wall an excessive quantity of silt was formed immediately north of the overflow and behind the east retaining wall. In the meantime the level of the overflow had been raised from time to time in order to raise the depositing level of the sand behind the wharf retaining wall. When sufficient sand had been obtained behind this wall, it was decided to deposit clean sand immediately north of the overflow in order to drive out over the overflow the silt which had accumulated in the settling-pool. Before this could be accomplished, however, the liquid silt began to scour out



ZANZIBAR HARBOUR

through the rubble under the retaining wall. As this happened at low water springs, with a head inside the walls of about 13ft., anxiety was felt for the safety of the wall. The dredger was stopped at once, so that very little scour actually took place, although about 300 cubic yards of silt and sand seeped through the rubble.

To prevent a recurrence of this clean sand was thrown by hand as a backing to all walls, and the sand level everywhere was raised to the level of the overflow—El. 9·00. Another corrugated iron baffle was placed to the north of the overflow, and pumping was resumed. It was found that by baffling the stream instead of training it, only silt and mud passed over the overflow. This was continued, and the overflow was always kept about 12in. above the sand level to prevent scour of the sand already deposited. When the sand level reached El. 13·00 this was stopped, and red earth was tipped to El. 17·00.

The discharge was now turned south and the stream was led along the back of the south wall with a free outlet until sufficient sand had been deposited to form a bank behind the south wall up to El. 14·00. The stream thereafter always had a free outlet, because, although the hand-made banks sealed the area behind the wall, a low outlet was left in the rubble slopes at the eastern end.

The author suggests that when dredged material is pumped into an enclosed area a settling-pool is dangerous, as it encourages the accumulation of mud and silt in one spot.

* Abstract of a paper communicated to the Institution of Civil Engineers.

THE MOTOR YACHT ISONDE.

IT has been decided to convert the 75ft. yacht "Isonde," belonging to the Ottoman Bank of Constantinople, from steam to motor propulsion, by installing in it a 110/140 B.H.P. eight-cylinder Parsons marine set, which it is anticipated will give a speed of 12 knots. The engine, with its combined reverse gear, is generally similar in design to the smaller unit described in THE ENGINEER of April 16th, 1926. It has eight cylinders, each of 6½in. bore with a stroke of 8in., and is designed to develop its full output at 750 r.p.m. The new machinery is easily accommodated in the boiler-room of the ship, so that the space previously taken up by the steam engine has now been made available for additional accommodation. The conversion of the yacht has been superintended by Mr. Malcolm McLaren, the owners' naval architect and Lloyd's representative at Constantinople, and the engine tests were recently made at the works of the Parsons Oil Engine Company, Ltd., at Southampton, and were supervised on behalf of the owners by Mr. R. G. Soper, of J. M. Soper and Son, of Southampton. An electric starting system is incorporated in the design, and the engine was quickly run up on petrol and changed over to paraffin, after which a continuous run of four hours under full load was made. Astern and slow running trials were then carried out, and we are informed that the engine ran very quietly throughout the trials, absence of vibration being marked, even although the engine was only held down to the test plate by four light clamping bolts and plates. The machinery has now been shipped to Constantinople.

Railway Matters.

IT is pleasing to record that according to a statement made at the annual meeting of the Railway Servants' Orphanage, the models of the "Rocket" at various stations, which are actuated by the insertion of a penny, produced last year 161,598 pennies, or over £673.

ASKED recently whether he had been consulted by the directors of the London and North-Eastern Railway as to a high-level railway into Liverpool-street Station, Colonel Ashley replied that he was not aware that the railway company contemplated such a scheme as that mentioned in the question.

IN connection with the note in this column on June 22nd, as to the increased facilities to be given at Fleetwood for fish traffic, it may be remarked that last year 1,600,000 boxes of fish were dispatched thence by train, as compared with 900,000 in 1913. In 1891 there was only one steam trawler operating from Fleetwood; now there are 200.

THE annual report of the National Union of Railwaymen, which was presented to that body when it met in Bristol on July 2nd, made mention of the subject of pilfering. It was said that numerous appeals had been made to the members to stamp out "this obnoxious class of case," and they were once more asked not to meddle with things seen lying about which were not their property. They should, by all means, take the earliest opportunity of calling the attention of a responsible officer, and thus assist in relieving the railway of an unfortunate stigma—that of pilfering.

THE Ministry of Transport announces that the annual railway returns for the year 1927 have been published, and can be obtained from the Stationery Office, price 16s. These are the returns of the capital, capital expenditure, receipts, expenditure, and statistical details of British railways as presented in the annual reports of the companies. They also include other information as to traffic, ton miles, train loads, coal and oil consumption, &c., supplied direct to the Ministry. It is a satisfaction to notice that the returns are published at 5s. less than formerly.

THE first paragraph in our Railway Matters column on December 9th last referred to the increasing use of electric stoves for cooking in the restaurant cars on the London and North-Eastern Railway. The further success that has attended the use of such stoves has led to the provision of plant for charging the accumulators at Aberdeen, Glasgow, Newcastle, Manchester, Bradford, Sheffield, Parkeston Quay, Marylebone, and Liverpool-street. Charging plant is already in use at King's Cross, Leeds and Edinburgh, and, therefore, all stations that are the starting points for the journeys of restaurant cars will have them.

THE train alterations which will be made by the London, Midland and Scottish Railway, on the introduction of the summer service on July 9th, include the running of the "Royal Scot" between London and Edinburgh and Glasgow on Sundays and the corresponding up train. That will be a new departure, and additional to the present day Scottish trains on Sunday. The night express to Inverness will run non-stop from Crewe to Perth, 292 miles, and the up night train from Glasgow will make no call between Glasgow and Crewe, 243¼ miles. The North Wales morning express will, as in previous years, run non-stop from Euston to Rhyl, 205¾ miles.

THE method of controlling the working of single lines of railway by means of a train staff or other token universally used in Great Britain and in those countries—like India, Australia and South Africa—where British operating methods prevail, is not employed on the Continent. European railway systems rely entirely on the block system—mostly lock-and-block—and the success that attends those means, viewed from the standpoint of safety, has been remarkable. There was, however, a very serious accident on June 22nd on the Swedish State Railways when the Stockholm–Norrland night express met, head-on, a light engine running in the opposite direction. Twelve passengers were killed, as well as the driver of the express and the fireman of the light engine.

THE railway disaster at Darlington on June 27th has been spoken of in the daily Press as the worst railway accident "since the war." If that means since 1918, the situation is slightly better than that. Actually, it is the worst since the Quintinshill disaster of May, 1915. Excluding the latter, also the Armagh accident of June 12th, 1889, we have to go back to the Hexthorpe collision of September 16th, 1887—over forty years ago—and the Bullhouse—Penistone—derailment of July 11th, 1884, for a comparable accident as regards loss of life. Twenty-five were killed at Hexthorpe and twenty-four at Bullhouse. Prior to that and excluding, now, the Tay Bridge failure, the worst was the Shipton-on-Cherwell of December 24th, 1874, when thirty-four were killed, and the Abergele disaster of August 21st, 1868, when the deaths numbered thirty-one.

THE recent Ascot Races remind us that the London and South-Western Railway had been opened for twenty-seven years before it had a serious railway accident; in fact, the only accident up to that time in which there had been a loss of life was when one passenger was killed in a derailment at Bishopstoke on June 20th, 1858. At Egham, on June 7th, 1864, the first of two return trains from Ascot was standing in the station when it was run into by the following train, the driver of which had not been advised that the first was calling at Egham, and seven passengers were killed. The case is instructive to us to-day in that the Board of Trade inspector said that if the railway companies would not voluntarily adopt the block system the Legislature should interfere and compel them to do so. Colonel Yolland added: "Apparently, these matters are looked at entirely in a commercial point of view, and, generally, it is deemed more expedient to run the risk of sacrificing human lives and inflicting dreadful injuries to individuals, and to accept the liabilities which such occurrences involve in the shape of heavy compensations, than to incur the certain cost of making a change in an established system to one that may be more expensive, though it will certainly be more safe."

Notes and Memoranda.

IT has been found in Western America that a grid of wires spaced from 40ft. to 50ft. apart each way and suspended about a foot above the water surface, will stop seagulls from alighting on the surface of potable water reservoirs and causing a nuisance.

WORK is now proceeding on the righting of the concrete caisson for the Mid-Hudson Bridge, Poughkeepsie, New York, which partially overturned a year ago. It weighs about 19,000 tons and measures 60ft. by 130ft., and will be over 100ft. high. It listed over to an angle of nearly 45 deg. in the early stages of sinking, and is being righted by dredging and pulling with heavy tackle on the high side.

DURING 305 working days in the past year the elevators in fifteen prominent office buildings in the Grand Central zone of New York City transported 33,592,348 persons in both directions. The total number of trips made by 107 cars was 4,577,583 and the total distance was 378,000 miles. The company also reports that there has not been a serious accident in the buildings in ten years, and in the last two years cars have only been stalled four times.

THE electrification of factories is proceeding at a rapid pace in the United States. Since 1919 the total increase of 6½ million horse-power in factories has been in electrical motors purchasing power from interconnected systems. Over 70 per cent. of the total of 41,000,000 horse-power prime movers in factories is now electrical. On the average each factory wage earner is aided to-day by 4·3 horse-power. This amount is twice as great as in 1910.

A NEW cotton fabric for use in highway construction is reported to have been produced by the new Uses Section of the New Orleans Cotton Textile Institute. The new fabric was developed by the Bureau of Standards in Washington in co-operation with the Institute's textile engineers. The fabric is stated to be a loose cotton mesh. It is laid over a cement base, and on top of the fabric the surface of the roadway is moulded. The layer of fabric provides a cleavage plane between the surface of the road and the foundation, so that, in case of repair, the top layer of the roadway can be removed and a new surface laid down without impairing the permanent foundations.

THE first entirely automatic power station in Sweden is about to be put into service. The station has been built on the Kolbaeck River for the big industrial company Surahammars Bruk, which owns ironworks, sawmills and paper and pulp mills. It is to run entirely without human supervision. The turbines will automatically adapt themselves to the supply of water, and possible accidents will be reported automatically to the company's telephone station. The station is wholly of Swedish make, the Karlstads Mekaniska Verkstads Aktiebolag having supplied the turbines and Asea the electric machinery. The Surahammars Bruk already possesses several power stations on the same river, and if the automatic system is found to work well they will probably also be transformed into automatic stations.

PERHAPS the most unusual, and certainly the most spectacular of the late attempts to use waste woods, is, according to the *Paper Makers' Monthly Journal*, that in operation at the plant of the Mason Fibre Company at Laurel, Miss. Chipped waste wood is fed to so-called guns, which are merely steel cylinders of small capacity, so arranged that a valve at one end of each cylinder can be tripped instantly. The chips are first maintained at a pressure of roughly 200 lb. per square inch for from ten to fifteen seconds, which, it is claimed, softens the lignins without causing damage to the cellulose fibre. The pressure is then raised to 1000 lb. for from three to five seconds, following which the valve is tripped, releasing the contents to a cyclone separator. The sudden release of pressure causes the chip to explode, resulting in a fairly long-fibred pulp, which consists of cellulose encrusted with the original wood lignins.

AN account of the performance of a Diesel engine fed with fuel oil distilled from coal by the low-temperature process is given by Mr. J. S. Brown, in the *Journal* of the Royal Technical College, Glasgow. In each case the engine was worked up to full load and normal jacket temperature on a normal petroleum oil, and the fuel was then gradually changed to that under test. In one case excessive viscosity caused an airlock in the feed, but the performance on the other two oils was entirely satisfactory with the engine under full load. In the case of one oil only was it possible to avoid pre-ignition when the engine was running at no load. In neither case was it possible to start the engine without preheating the jackets. Two of the three oils gave a small amount of deposit when mixed with Shell-Mex Diesel grade oil. These oils, the author considers, preferable to the creosote oils previously obtained from coal, and in his opinion a little further improvement in the quality would give them all the properties of a petroleum oil.

TWO Swedish engineers announce a new method for brick making, called the "dry method," whereby the necessity of placing brick factories in the localities where clay is to be had is eliminated. Instead of manufacturing the bricks directly from the clay as has previously been done, the clay is treated by heat or vacuum and then pulverised, whereby a half-finished product called "clay metal" is obtained. This clay powder can easily be transported to suitably located factories, where it is again moistened and mixed and subsequently placed in moulds and pressed. The bricks are then placed on specially constructed wagons which are slowly passed through a tunnel oven, where the bricks are baked. The building material is then ready to be transported to the place where it is to be used. The inventors claim the following advantages for their new method:—Only one manual process is required in moving the bricks from the moulds to the wagons, the powder is more easily handled and transported and may be ordered only in the quantity needed in each case, thus eliminating the expensive loading, unloading and storing of the bricks, whereby considerable saving of expense and manual labour is effected. The inventors believe that their method may revolutionise the old method.

Miscellanea.

IT is proposed to hold the next International Road Congress at Washington in 1930.

ARRANGEMENTS are being made for the development of 600,000 horse-power on the St. Maurice River, Quebec.

THE manufacturing plant of the Canadian General Electric Company at Peterborough, Ontario, is to be extended.

A COMPANY with a capital of 600,000*l.* has been formed in Tunis for the production of refined sulphur and its derivatives.

A HYDRO-ELECTRIC plant at Mori (Rovereto, Italy), to produce 120 million kWh, is nearing completion. This current will be used to convert alumina, made from bauxite, into aluminium.

MORE than fifty aeroplanes are operating in Manitoba this year, of which twenty-five are used in the Government service, carrying mails, patrolling forest areas, map making and doing wheat rust research work.

THE expansion of the present plant of the Canadian General Electric Company at Peterborough, Ontario, involves the expenditure of approximately 800,000 dollars. Of this amount, 300,000 dollars will be devoted to the erection of two buildings of considerable size, and 500,000 dollars will be required to provide machinery and equipment.

HIGH-GRADE bituminous coal has been discovered at Little Forks, about 7 miles from Springhill, N.S. The deposit, which is said to be one of the richest found in Nova Scotia for many years, consists of two seams. The overlying seam, about 35ft. below the surface, is slightly more than 3ft. thick. The other seam is about 30ft. below it and is 5ft. thick.

THE Nicaraguan Government has authorised the establishment of a National Association of Engineers for the carrying out of Government and private contracts. Foreign engineers of more than five years' residence in the country may become associate members. The Association when acting as technical adviser to the Ministry of Fomento must work without remuneration. No contracts for public utility works can be placed before the Association has been consulted and the agreements approved by it.

THE latest investigation into the coal resources of the country to be undertaken by the Department of Scientific and Industrial Research is to cover South Wales. Since the survey was started, the work has been mapped out into areas, of which one is Scotland, the others being Durham and Northumberland, Lancashire and Cheshire, South Yorkshire, and Nottinghamshire and Derbyshire. The object of the survey is to investigate the characteristics of the various coal seams in the country with a view to their utilisation to the best advantage.

THE Government of Italy is making strenuous efforts to find new coal strata. Deep drillings are taking place near Montaione in Tuscany and at two spots near Palermo in Sicily. The lignite mines which were operating have diminished from 240 in 1918 to 48 in 1927, and to 41 in the early part of 1928. The production has also decreased from 2,117,000 tons in 1918 to 1,075,220 in 1927. The difficulty lies in producing lignite at a profit owing to the cheapness of other imported fuels and the relatively high cost of labour. Every possible method is being studied to remedy the situation. One large electrical station is being built at Gualdo Cattaneo in which it is calculated that 1 kWh can be produced by 3 kilos. of lignite. If the experiment is a success it might tend to save the lignite mining industry from dissolution.

THE chairman of the Preston Electricity Committee, Mr. Heaney, describing at a meeting of the Town Council recently the effect of the proposal of the Electricity Commissioners on the Preston undertaking, which is to be the second largest in the N.W. area, said the output was three and a-half million units in 1921, and it had gone up to forty millions this year; by 1931 it was to be two hundred millions, and by 1934 four hundred and twenty-one millions. From a position of obscurity in the electricity world Preston had jumped into one of the most prominent places in six years. The average price obtained in 1922 was 5¼d. per unit, and this had gradually fallen to 1·2d. and the undertaking was "nicely profitable," despite the fact that they paid about £300,000 to buy out the old private company whose plant they immediately proceeded to scrap, and had spent about £1,500,000 on the new power station.

WITH the passing of the Jones-White Bill it will be possible profitably to develop United States shipping by means of co-ordination of air and sea transportation. This corporation was formed last January for the purpose of operating the proposed Blue Ribbon Line of 33-knot vessels across the Atlantic. In the course of an article in the *American Mutual Magazine*, Mr. R. L. Wilder predicts the development of a new and distinct type of vessel under the United States flag. This, he says, will have masts, funnels and bridges on one side, like the aeroplane carriers "Lexington" and "Saratago," leaving the whole deck clear for the landing and take-off of aeroplanes. "It is inevitable," he writes, "that ships of the air and ships of the sea should work together. They are natural partners. By use of aeroplanes, to-day's mail will catch yesterday's ship out at sea, and to-morrow's mail, by flying ahead of the ship, will be delivered to-day."

IT is understood that the Glasgow company known as Aerial Taxis (Ltd.), which is already associated with proposals for the institution of a regular service of aircraft between Glasgow and Belfast, has made an offer to the Government to carry the West Highland mails—to provide aircraft to do the work at present done by the steamers owned by David MacBrayne (Ltd.). The company has submitted a formal tender, in which it offers to maintain a regular service between the mainland and the Western Isles for mails, passengers, and a limited amount of goods. As yet, the routes have not been surveyed, and no decision has been reached as to the types of machine or machines which might be employed, but if an encouraging reply is obtained from the Government a survey will be made, and the question whether aeroplanes or seaplanes should be used will be investigated. At present the company is understood to favour seaplanes.

THE LOCHABER HYDRO-ELECTRIC POWER SCHEME

(*For description see page 8*)

FIG. 19—GENERAL VIEW OF EXCAVATIONS FOR POWER-HOUSE FOUNDATIONS

FIG. 20—PIPE LINE FROM NO. 3 ANCHORAGE

The Engineer

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THE ENGINEER.

JULY 6, 1928.

The Victory and the Barham.

ON Friday of last week the Institution of Mechanical Engineers brought its Summer Meeting to an end by visiting Portsmouth and inspecting the Royal dockyard round which the city's life has centred for the past seven hundred years. It was a fitting conclusion to a memorable meeting, for it afforded the visitors, their minds freshly impressed with the sumptuous wonders of the "Homeric" and the "Aquitania," an opportunity for studying the old and the new order in warship construction as represented by H.M.S. "Barham" and H.M.S. "Victory." The inspection of the "Barham," it is worthy of note, was of no mere cursory kind. The visitors were not hurriedly shepherded past or through those parts of the ship's anatomy which they might have expected to be guarded with jealous secrecy. Their attention was not forcibly confined to the serving out of the daily grog ration, the messing of the crew, the parade of defaulters, and other everyday aspects of life on a warship. They were allowed, even invited, to descend into the engine-rooms, to climb to the highest point of the conning tower, to examine the system of fire control, and to enter one of the turrets and witness the hydraulic operation of a 15in. gun. Even although the ship was in the joint possession of her crew and the dockyard workmen, even although her decks and spaces were in the state of disorder attending the concluding stages of an extensive refit, the visitors were enabled to obtain more than a glimpse into the constructional features of a modern battleship and to see something and learn more of the domestic conditions in which a man-of-war's man of to-day lives and has his being. Except in the officers' quarters, there is little that can be described as luxurious. Everywhere, even in the Admiral's cabin in the conning tower, stark efficiency ruthlessly dominates comfort. So great is the demand for space for fighting and propelling equipment that eighteen inches is still all the room that can be allowed to swing a hammock, and even then some of the ship's company have to lie "hard" and sleep as best they can on the bare deck. Nevertheless, the general impression left on the visitor is one of a self-respecting body of healthy men following a life which is far from being unbearable, governed by a discipline which, though strict, allows them much freedom and many opportunities for amusement, and engaged in a calling of varied interests and affording them good opportunities of advancement.

Leaving the "Barham" and the bustling activity attending her preparation for a farther period of active service, the visitors passed on board the "Victory," now a land-locked pensioner and almost restored to the state and form which she had at Trafalgar. It was as vivid a contrast as could well have been arranged. We left the modern world and at a step passed back to the life which still lingered within the wooden hulls of the sailing warships of eighty years ago. The scenes, mostly grim, the tragedies, the disciplinary severity, the hardships of the common sailor's life, made familiar to us by the books of Smollett and Marryat and Herman Melville seemed to take shape as we trod the "Victory's" gun decks and explored the cramped, dim-lit accommodation below. It is true that Melville's "Neversink" was a United States frigate, and that in point of age she was considerably junior to the "Victory." However, men-of-war and man-of-war's men were much the same in Melville's day as in Nelson's, and the American Navy was still faithfully modelled on the British. For the spirit in which the old wooden walls of England are regarded, Dibdin is largely responsible—Dibdin who after a passage from London to Torbay changed his mind about becoming a sailor and returned to shore to write patriotic nautical ballads as an Admiralty pensioner. Melville served as a common sailor, barely escaping on one occasion the flogging at the gangway which was the common sailor's all too common punishment in his and Nelson's time. The visitor to the "Victory" must leave the old vessel persuaded that Smollett and Melville, rather than Dibdin, were right in their picture of life on the old-time battleship, that Nelson himself was right when he described that life in one word as "Hell." In fair weather with no enemy at hand, the breathless, low-pitched decks must have provided insufficient and insanitary accommodation for her crew of seven hundred men and boys. On the lower decks it was impossible to walk upright. Salt beef and biscuits formed the staple diet and the drinking water was, at times, weeks, if not months, old. Almost the only recreation permitted was cock-fighting. The space reserved for that elegant pastime was situated on one of the below-water decks. To this cockpit, lit by a pair of battle lanterns, the wounded were brought in time of action for treatment by the crude and cruel surgery of the day. There Nelson himself was carried to die. In action the gun decks must have been an inferno. Distributed between the three were something over a hundred guns, each of which was served by a crew of four or five. The training of the guns was performed entirely by hand, with the assistance only of levers, pulleys and tackle. In order to sponge, load and ram them, the crew had to expose their naked bodies at the gun ports, and as the range of the action could not exceed eighty yards, the casualties suffered in the intervals between firing were numerous. In order to render the appearance of the ship after action less terrible, Nelson commanded that the gun ports of the "Victory" should be painted red, and to that colour the Society for Nautical Research has now restored them. And of the men, the common sailors, who fought the guns and sailed the ships, shall we believe that they were the simple, courageous, devoted patriots of whom Dibdin sang? Or shall we believe with Melville and as contemporary history teaches us, that they were drawn from all classes, from the colleges, streets, and gaols freely, or by compulsion of the press-gang?

The poets tell us that steam and the engineer have killed romance at sea. Romance, we are convinced, never did exist between decks in a sailing warship. There is more of it to be found in a modern "Dreadnought" than in a dozen "Victorys." The engineer is essentially a realist, and the intensity of his realism compels him to see with his own eyes and not through the eyes of the poets, what lay behind the "wooden walls of old England." As engineers, we rise to the romance embodied in the "Barham" and that which it supremely typifies—man's acquisition of command over the elements and natural forces. From the conning tower to the engine-room, from the turrets to the wireless station, even in the ship's shop and the cinematograph carried for the crew's entertainment, the modern warship is the home of a

romance which did not and could not have flourished in the evil quarters and cruel ways of an old-time sailing ship. However glorious and inspiring a ship of the line may have looked with all her sails set, she must have lacked that impression, which we know is more than an impression, of controlled strength which a modern warship exhibits in every aspect. Beauty of line may at times be absent—there is hardly anything more conceivably ugly than the aircraft carrier "Argus"—but in some vessels of the fleet of to-day, and especially in the new 10,000-ton cruisers of the "County" class, there is a beauty of line to which no vessel built of wood could attain. Engineers are frequently blamed for, and themselves sometimes feel ashamed of, the loss of beauty which they have or are said to have inflicted upon the world. Those who would judge us in this matter are, we feel certain, frequently blinded by the false romance associated with the men and the productions of a former age, and are equally blind to the romance which the engineer has created and is creating beneath their own eyes in their own life-time. Hallowed by her age and her history, we do right to preserve the "Victory" as a memorial of Nelson and his men. But let us be for ever thankful that progress has given us the "Barham," and that with that progress there have passed away the many gross evils and the barbarism which, outside the novels and poetry books, accompanied naval service a century ago.

The Darlington Railway Accident.

THE railway disaster at Darlington on June 27th may prove to be, with the exception of the Tay Bridge calamity and the exceptional accidents at Armagh and Quintinshill, the worst, measured by the number of casualties, since the Shipton-on-Cherwell derailment of December 24th, 1874—fifty-four years ago—when thirty-four passengers were killed. But, bad as the Darlington collision was, our faith in the safety of British railways is maintained. Although the number of persons killed or injured is, very naturally, taken as the measure of the seriousness of accidents, it is in fact the number of accidents rather than the number of fatalities which should be considered in making an estimate of the safety of railways. In many accidents there is the potentiality of disaster, and when crowded trains are involved it is rather to be regarded as an evil turn of fortune than a greater defect of railway working. When the density of the traffic and the number of stations, junctions and sidings are considered, together with the potential results of an oversight or a slip by one of the 40,000 drivers, the 35,000 firemen on whom those drivers often rely, or the 30,000 signalmen, it is remarkable that accidents are so infrequent. During the twelve and a-half years since December, 1915, there have been thirty-two fatal accidents on British railways, and in only eleven of them have more than three passengers been killed; in seventeen there was only one; in one there were two killed; and in three cases there were three. Such results are eloquent testimony to the care with which railway servants do their duty and to the safety appliances provided to assist them therein.

The coroner's inquest was opened on Friday last, but only to deal with evidence as to identification, and it was then adjourned until next Tuesday week, July 17th. The Ministry of Transport inquiry was held on Saturday by Colonel Sir John Pringle, but, as yet, the driver and fireman most concerned have not been able to give evidence owing to the injuries they received. There is, therefore, only the signalman's version of the facts before us, and consequently the whole story cannot be told, nor, in view of the possibility of a charge of negligence against any of the parties concerned, is it desirable to discuss the probabilities. Darlington Station has, in effect, one long island platform, running due north towards Newcastle and due south towards York, and on the up side there is a road next to the platform and two other through roads between the platform line and a wall on the east side of the station. The south end of the station is protected by the South Box and the north end by the North Box, and between those signal-boxes there are, outside the east wall of the station, two running lines by which through non-stopping trains avoid Darlington Station itself. The ill-fated train was an excursion to Scarborough, returning to Newcastle, and as it had not to call at Darlington it was sent over the down avoiding line. There are certain connections in the station between the three lines on the up side and they are actuated from the Platform East Box. Just before eleven o'clock a parcels train was doing work on the up side in the station and during those operations it drew forward towards the junction at the south end of the station and so fouled the path of the excursion, for which train, it seems, there is no question that the signals were at "clear." How the parcels train came to be there—whether the signals were passed at "danger" or whether it was irregularly signalled forward or whether the signals were misread—is a question that will no doubt be cleared up at the coroner's inquest on July 17th.

Until it is known what was the cause it is useless to discuss the remedy or remedies for such a contingency. There is, however, one engineering feature that will, no doubt, receive attention at the hands of Sir John Pringle. We refer to the telescoping of the second and third coaches. Though an excursion train, the vehicles were of bogie stock, two being former North-Eastern and nine of the old Great Central. When two trains meet head on there is so great a disturbance among the vehicles behind the engines that telescoping is almost bound to occur. In fact, although the effects are very unfortunate for those in the telescoped coaches, it is possible that greater rigidity might lead to more serious results.

Literature.

Studies in Molecular Force. By HERBERT CHATLEY, D.Sc. London: Charles Griffin and Co., Ltd. Price 7s. 6d. net.

IT is perhaps not too much to anticipate that one day all our problems in the strength and elasticity of materials and many of our metallurgical problems will be capable of being attacked from a basis resting on a full and intimate knowledge of the molecular forces which hold the materials together and which are the ultimate source of the various properties which they display. It is at least certain that the study of intermolecular forces, highly academical though it be to-day, will, as soon as it reaches a fairly developed stage, acquire a practical bearing possessing vast possibilities. For that reason we are of opinion that good service can be rendered by anyone who will give engineers and metallurgists a review, neither too extensive nor too abstruse, of the existing state of knowledge and of the prevailing theories on this fascinating branch of modern physics.

We are not clear as to whether Professor Chatley, in compiling these "studies" in molecular force, intended to provide such a review, or to supply, in the main, an original contribution to existing knowledge and speculation on the subject. He writes throughout as a physicist pure and complete, and at many points relies on his reader's possessing a greater knowledge of modern physics than the majority of engineers, in our experience, claim to have. He is, however, himself an engineer, and it is therefore probable that he meant his book to appeal to engineers as well as to physicists. His intentions in this respect are not of as much importance as they might otherwise have been, for the book will, in our opinion, appeal to but few of either class of reader.

The work displays a large and close acquaintance on the part of its author with the views and theories advanced in modern times by the large body of scientists who have studied the ultimate structure of matter and the forces which exist within it. Had the author been content to present these views and theories and to point out wherein they were consistent or inconsistent with each other and with the rest of physics, he would have performed a useful and not too easy task. He has, however, endeavoured to shoot beyond that mark and to provide his readers with a background of ostensibly logical argument whereon to fit as best may be the separate pieces of a perplexing jig-saw puzzle. We do not blame him, because he himself fails to make the pieces fit. We do blame him, however, for advancing as logical an argumentative background which it requires no great knowledge either of logic or of physics to tear to shreds.

On the first page of the first chapter the following general statement is printed in heavy type: "The force of attraction or repulsion between two average simple molecules in a solid or dense liquid state usually lies between one-hundredth of a microdyne and one hundred microdynes." A microdyne is one-millionth of a dyne. This statement is made much use of in succeeding chapters. It is used as a means of evaluating other factors in the problem and to check the sufficiency of various theories. It is employed, for instance, to prove that the intermolecular force is very much greater than can be accounted for by the frequently made assumption that it follows the Newtonian gravitational inverse square law, and to demonstrate that if the law followed is of the form $k\,m^2/d^n$, the least value of n that will account for the force "known to exist" is 6.

It is clear that we cannot establish the falsity of one theory by assuming that another theory is right. The statement we have quoted must therefore, if we are to use it for the purposes indicated, be of a wholly experimental origin. In support of the truth of the limiting values for the molecular bond given in the statement, Professor Chatley quotes evidence from the surface tension in films, the strength of materials, the fusion of solids, the expansion of solids with heat, the vaporisation of liquids, and other physical phenomena. All this evidence is open to the same line of cross-examination. We will therefore deal specifically only with the evidence derived from the strength of materials. Taking the strength of tool steel at $2{\cdot}5 \times 10^{10}$ dynes per square centimetre, and the number of molecules at 10^{15} per square centimetre, Professor Chatley divides the one figure by the other and gets 25 microdynes as the minimum value of the bond between a pair of molecules across the plane of tension. This figure does not command our respect. The numerator of the ratio from which it is derived is of experimental origin, but the denominator, the number of molecules per square centimetre, is not and cannot be derived otherwise than from some antecedent theory. The figure is therefore not admissible as wholly experimental evidence in favour of the general statement.

Again, while the numerator, the tensile strength of tool steel, is determinable experimentally, it is an unproved assumption that the tensile strength of metals as determined by engineers is wholly or even largely a reflection of the magnitude of the molecular bond. The large differences between the strength and elastic properties of aluminium and other metals when in the form of single crystals and when in the usual polycrystalline form, clearly establish the fact that the molecular bond is not the sole deciding factor in settling the value of the properties measured in a testing machine. Current research, it may be remarked, shows that the strength of single-crystal specimens is in general considerably *less* than the strength of the same metal in polycrystalline form.

Neither of these objections to Professor Chatley's evidence in support of his general statement is comparable in gravity with a third, which no doubt most of our readers will have already seen. By dividing the tensile strength by the number of molecules to obtain the molecular bond, Professor Chatley implies that the tensile strength is entirely to be ascribed to the forces between the molecules of two layers, one on each side of the plane of tension, and, further, that each molecule in one layer attracts only one molecule in the other layer. This proceeding is not, however, performed without defending it. We are, in fact, told just before the general statement is made that "the contribution of adjacent molecules to the force between any particular pair is not necessarily very large and for the present, therefore, may be neglected."

The "proof" that this contribution is small is to be found in the second chapter, and it is here that the author lays himself open to the gravest charge of offending against the rules of logical argument. In the second chapter he discusses the effective range of molecular force and, calculating in various ways, seeks to show that that range is of the order of one-millionth of a centimetre. These calculations—certainly two of them—are directly dependent on, and can be completed only from a knowledge of, the magnitude of the molecular bond. For that magnitude the author takes the limits—incidentally misquoting them—set forth in the general statement! He is clearly arguing in a circle, and assuming the truth of a proposition in order to prove it. His argument may be summarised thus: Statement A is true. It is supported by experimental evidence B. Experimental evidence B involves an assumption which is shown to be true by calculation C. We protest against this argument because, as we have said, calculation C deliberately assumes that statement A is true.

If we ignore these flaws in the author's treatment and accept his figures as being substantially correct, we must still be left wondering why he deduces from them that "the contribution of adjacent molecules to the force between any particular pair is not necessarily very large and for the present therefore may be neglected." His own figures seem to us to prove that the direct contrary is true. If, as he says, the effective range of molecular force is about one-millionth of a centimetre, then we would reply that that range on his own showing is large relatively to the molecular diameter. That diameter in the case of tool steel is, he states, about 10^{-8} cm. In other words, the diameter is only about one-hundredth of the effective range of the force. It therefore follows that the tensile strength is contributed to not by one layer of molecules on each side of the plane of tension, as the author implies, but by about a hundred layers on each side, and by the attraction of each molecule, not on one other, but on many others. Within the effective range of a molecule lying just below the plane of tension there is above that plane, not merely one molecule, but half a million molecules, all of which contribute at least a component to the tensile strength.

It is to be noted that the author's neglect of the contribution from adjacent molecules must act in the direction of greatly increasing the magnitude of the bond estimated to exist between a particular pair. It is, therefore, not surprising to find that later on Professor Chatley is able to "prove" that Newtonian gravitational attraction is insufficient to account for the magnitude of the bond "known to exist" between a pair of molecules. We are aware that others have

arrived at the same conclusion. We do not intend to dispute it. For the present, we are merely concerned with the manner in which Professor Chatley seeks to establish it.

We need not follow the author throughout the remaining chapters of his book. It is sufficient to say that, in common with many others, he finds unmistakable indications that molecular force is of an electrical nature, and that it is the joint effect of a series of repulsions and attractions. In so far as the book presents an account of current work and opinion on the nature of intermolecular force and the law which it obeys, it is worth studying. It is not, however, always easy to discover whether the views expressed and the conclusions arrived at are the author's own or those of others. In so far as they are the author's own, they must, we feel, be accepted only with great caution, and after considerable investigation into the basis on which they are founded.

SHORT NOTICES.

Brassfounders' Alloys. By J. F. Buchanan. London: E. and F. N. Spon. 1928. 10s. 6d.—This is the second edition of a useful little book of an essentially practical nature. It has been revised to include accounts of the most modern practice in alloying, not only brasses and bronzes, but also other non-ferrous metals, such as aluminium, magnesium, &c. The proportions, method of mixture and the properties of a very large number of alloys are given, together with occasional hints on the process of casting. There are a few notes on the qualitative testing to determine the metals in an alloy.

Steam Condensing Plant. By J. Evans. London: Sir Isaac Pitman and Sons. 1928. 7s. 6d. net.—This book is principally of the descriptive type, and covers practically every known type of condenser, either surface, jet or evaporative. Air pumps, air ejectors and cooling towers are also dealt with. The descriptions are not extensive, but bring out the salient features of the various forms, and enable comparisons to be made for individual services. The theory and design of surface condensers is dealt with at some length, while hints on the discovery of the loss of vacuum are given.

Excavating Machinery. By W. Barnes. London: Ernest Benn. 1928. 42s.—A most interesting book containing a great fund of information concerning British and American excavating machinery. It includes a few historical notes and an explanation of the fundamental principles of the several classes of machine, such as the shovel, the drag line and the grab. Then follows a series of general descriptions of the machines and their constructional details. One of the most interesting parts of the book is, however, that which deals with the application of excavators to actual work, examples being drawn from all parts of the world. Some practical hints are given for the prospective purchaser and user. The book is well and thoroughly illustrated, and is printed in large type, so that it is easy to read.

The Preparation of Coal for the Market. By Henry Louis. London: Methuen and Co. 1928. 10s. 6d.—This book is a reproduction of a short series of lectures given by Professor Louis at the Heriot-Watt College, Edinburgh, under the auspices of Mr. A. France-Fecquet, of Liége, and urges the necessity for the adoption of thorough cleaning systems if the coal industry of this country is to survive foreign competition and to utilise the fuel to the best advantage. The Professor puts forward his subject in a very lucid manner and describes the various processes and the plant they involve very pleasantly—the chapter on "Froth Flotation" is most enlightening to the uninitiated. The sizing of coal and the treatment of lump and fine coal are dealt with, and there is a chapter on the "Designing of Cleaning Plants."

The Engineer's Year Book for 1928. Compiled and edited by H. R. Kempe and W. Hanneford Smith. London: Crosby Lockwood and Son. 1928. Price 30s. net—For thirty-five years "Kempe," each time larger than before, has appeared in the spring, and, if our memory serves us rightly, this is the thirty-fifth time that we have said what an excellent and invaluable book it is. Amongst engineers it is as well known as "Molesworth," and if it cannot be slipped into their pockets it is found on their desks. Its characteristic is that it is a wholesome mixture of science and practice. It contains not only tables and formulæ covering nearly all branches of engineering, but it illustrates and describes briefly typical examples of the machinery and appliances used by engineers, and through the services of a Buyers' Guide, puts the reader on the track of such things as he desires to buy. With regard to this, the latest edition, it is only necessary to say that it has, once more, been brought up to date.

BOOKS RECEIVED.

Probability and its Engineering Uses. By T. C. Fry. London: Macmillan and Co., Ltd., St. Martin's-street, W.C. 2. Price 30s. net.

Modern Roadmaking. By H. Bradley and C. C. Hancock. London: The *Contractors' Record*, Ltd., 329, High Holborn, W.C. 1. Price 15s. net.

The Book of Remarkable Machinery. By Ellison Hawks. London: G. G. Harrap and Co., Ltd., 39, Parker-street, Kingsway, W.C. 2. Price 7s. 6d. net.

Descriptive Geometry. By W. H. Kirchiner and H. C. T. Eggers. London: The McGraw-Hill Publishing Company, Ltd., 6, Bouverie-street, E.C. 4. Price 11s. 3d. net.

City and Guilds of London Institute, Department of Technology: Programme, 1928–1929. London: John Murray, Albemarle-street, W. Price 4s. 6d. net.

Annual Report of the Chamber of Shipping of the United Kingdom, 1927–1928. London: The Chamber of Shipping of the United Kingdom, 28, St. Mary Axe, E.C. 3.

The Causes of Failure in Wrought Iron Chains. By H. J. Gough and A. J. Murphy. London: His Majesty's Stationery Office, Adastral House, Kingsway, W.C. 2. Price 7s. 6d. net.

The Principles and Practice of the Dilution Method of Sewage Disposal. By W. E. Adeney. London: The Cambridge University Press, Ltd., Fetter-lane, E.C. 4. Price 12s. 6d. net.

The Supervision of Building Work and the Duties of a Clerk of the Works. By J. Leaning. Third edition. Revised by H. J. Leaning. London: B. T. Batsford, Ltd., 94, High Holborn, W.C. Price 5s. net.

Newcomen Society.

SUMMER MEETING AT STOURBRIDGE.

For the Summer Meeting of the Newcomen Society this year, Worcestershire was chosen because of its long and varied association with industry, especially in the last 300 years. We need name only broadcloth, coal mining, chain, nail and other iron smithing, the slitting mill, iron smelting, flint-glass and fire-resisting materials. With these are associated the names of Dud Dudley, Richard Foley, Ambrose Crowley, and others. Of very particular interest to the Society is the fact that in 1712 Thomas Newcomen, from whom it takes its name, erected his first steam engine in this county. It was somewhere near Dudley Castle, but, alas! the precise spot is not known, otherwise a pilgrimage would indubitably have been made thither. It is hoped that research may yet reveal it.

A pleasant reunion of members and friends took place on Wednesday evening, June 20th, at the headquarters, the Talbot Hotel, formerly the residence of the Foley family. Many a chin wagged and much good-humoured chaff was indulged in when, arising from the exigencies of hotel accommodation, one party after another drove away to sleeping quarters.

Thursday morning broke showery, but brightened up later. A start was made at the chain-making works of Messrs. Baylie and Co., Ltd., where different sizes of chain were seen in process of manufacture. It was captivating to see the lengths of wrought iron bar bent, shaped, passed through the preceding link, scarfed, welded most carefully, and rounded with a swage hinged on an anvil with shaped beaks. One to three men were engaged, according to the size of link. The proving and annealing were also shown.

Bradley's Rolling Mills were then visited, as in a derelict part of the works was Foster and Rastrick's foundry, where the "Stourbridge Lion," the first locomotive on rails in America, was built. Interest was excited by the discovery of two Rastrick waste heat boilers, apparently of recent construction, but a thrill was afforded by finding two of Murray's hypocycloidal engines, in which the connecting-rod is dispensed with by placing the crank pin on the pitch line of a toothed wheel revolving inside one of twice its diameter. A Whitworth friction nut feed drilling machine, quite octogenarian, was also "spotted."

The next move was to the flint glass works, which have been seated in Stourbridge since 1556. The party had to be divided between T. Webb and Corbett, Ltd., Webb's Crystal Glass Company, Messrs. Fiddian and Deeley and Stevens and Williams, Ltd., and at each of these works some specialty not seen by the rest was in evidence. The purity of the materials, the fritting, the melting in pots, the blowing and flashing of one colour on another was "spell-binding."

Lunch was dispatched at the Dudley Arms, and a short drive brought the party to Windmill End, a pumping station of the Staffordshire Mines Drainage Commissioners, where Mr. S. Millington showed a "pickle pot" atmospheric engine, standby, but actually working. If power of an engine could be assessed, as the Cornishmen thought in Watt's day, by its noise and "frightfulness," then this engine was indeed "dutiful."

The party had to move on, however, as the next visit was to gain some insight into the fire-clay industry. George K. Harrison, Ltd., threw open their works, and Mr. J. A. Mobberley, J.P., managing director, led the way. The weathering, tempering, pugging, moulding, and kiln firing of the clay were all shown, but the great adventure, braved even by many of the ladies, was the descent of the fire-clay mine, 140 yards deep, in a most confined cage, to mud and discomfort below. The clay is at the parting of the coal, and is got by boring with augers; a shot was fired by the miners to give the right atmosphere.

In the evening the Society held its annual dinner at the Talbot Hotel, the table being graced by his Worship the Mayor, Alderman L. J. Cook, and guests from the works visited. By an effort, oratory was restrained as a meeting followed, at which three papers were presented. Mr. W. J. Palfrey, C.C., talked learnedly, based on documentary evidence, about the local industries; Mr. W. J. Jenkins, B.A., B.Sc., dealt with the early history of coal mining in Dudley. Some interesting facts were revealed in the discussion by the local men present. A paper by Mr. Rhys Jenkins, Past-president, on "Stourbridge and Dudley," was not reached, owing to the lateness of the hour. Copies, however, were available.

On the second day, Friday, 22nd, the first visit was to Halesowen, to the works of Messrs. Charles Homes, nail, chain and odd-work makers, where the party was welcomed by Mr. W. E. J. Barlow. Chains, curb and spike, frost studs, gutter brackets, copper soldering bits, and galvanised screwed ties were in hand. A fascinating sight was to see a chain swivel turned out. The artist's name is David Priest, and he is certainly a high priest of the craft. The treat of the morning, however, was to see nails made by hand, as it was confidently believed that the trade was defunct. Mr. Barlow had arranged for some six outworkers to be in their little forges where, with the help of their olivers, they were turning out gate and countersunk clout nails. There is a market for them yet, owing to their holding power in trying situations, *e.g.*, rolling stock.

The next objective was to the rural village of Belbroughton, where scythe forging and grinding is carried on in the old-fashioned way by water power. At the works of Isaac Nash, Ltd., the party was met by Mr. Nash Bolton, who greatly elucidated what he had to show by a set of specimens from the rough bars to the finished scythe. The blade is forged from a compound bar formed of a piece of blister steel to give the edge, a piece of mild steel for the back, sandwiched between two pieces of wrought iron. The whole is brought to a welding heat and forged under a helve hammer driven by the water wheel. The grinding was a striking sight and the tempering is done in water. The works, it is true, have been much modernised, and the pyrometer is on the point of being introduced to control the last-named operation, so to satisfy the Simon Pures who wanted seventeenth century atmosphere, Mr. Bolton took the party to an outlying forge where a belly-helve, driven by a breast water wheel, pounded away with an unvarying stroke.

Contrary to experience in other visits, it was not difficult to get the party away, the reason being that it was near lunch-time. Sandwiches were partaken of by the roadside, within range of the Bell Inn, where drinks were procured.

Resuming the journey, Droitwich was reached. The pumping plant for the baths was inspected, but has been quite modernised. However, the baths themselves were visited, and the difficulties that have to be got over, owing to the corrosive action of the brine on metals, were realised.

For tea a surprise was in store. The party was taken to Impney Hotel, built in 1875 as a private residence on the model of a French château. As the afternoon was brilliantly fine, the view from the terrace gardens was exquisite.

The party was then driven to Huddington Court—an Elizabethan half-timbered moated house, possessed in Stuart times by the Winter family of Gunpowder Plot notoriety—where it was received by Mrs. Slater, who, with her husband, has restored the place. One connoisseur in the party revealed the catch in the wainscot of an upper room, giving access to a "priest's hole," and led the way in, regardless of his trouser's seat.

A short drive to Worcester enabled those who wished to do so to entrain for town, but more than twenty stayed till the morrow, when under the guidance of a local member the Royal Porcelain Works—founded in 1751—the Cathedral, the Commandery—fifteenth century hammer beam roof and panelling—St. Helen's Church—monument to Dud Dudley—the old half-timbered houses in the town, and the museum were visited by different parties. The day was again summery, and put a fine end to a meeting which, permeated as it was by the spirit of good fellowship, was voted the most successful the Society has yet held.

SIXTY YEARS AGO.

In our issue of July 3rd, 1868, under the title "Can the Steam Engine be Superseded?" we took Mr. John Bourne to task for having ventured in a recent work to say not only that the steam engine could be superseded, but that it was actually on the eve of supersession by simple and more economical contrivances. The work referred to was a monthly serial publication, "Examples of Modern Steam, Air and Gas Engines of the most Recent Approved Types." Mr. Bourne's name carried considerable weight among his fellow-engineers, and we expressed some concern at the possible effect of his rash prophecy. We thought it might lead astray "weak minds half trained in the truths of science," and that it might even undo all the work accomplished by such men as Grove, Faraday, Tyndal and Rankine. Had it come from a less significant authority than Mr. Bourne, the statement, we asserted, would have been beneath notice. Mr. Bourne, it seems, was silent as to the direction from which was to come the simple, economical substitute for the steam engine. We proceeded to examine the possibilities with a view to showing that nowhere was there any sign of hope for the fulfilment of the prophecy. In electricity or magnetism there was no hope, for—a point still not realised by all engineers of that date—electric and magnetic machines were not capable of giving a ready store of power at first hand, but merely converted second-hand power into another form. Even though electricity could be produced without the expenditure of power, we would not, we said, make much progress. Electricity did not readily lend itself to labour. We were beset with difficulties when we tried to make it turn a wheel, and even for carrying our messages it required humouring and courteous attention to its whims and foibles. There was, we noted, only one direction in which to seek the coming wonder. It must be a heat engine dispensing wholly or partly with water. It could not, however, be a hot air engine, which, though proved to be economical lacked permanence, freedom from wear, compactness, and simplicity. It was not safe to use superheated steam much hotter than 280 deg. With that as the maximum temperature a hot air engine would give an effective pressure of about 7 lb., and consequently for the same power marine steam engines with cylinders 100in. in diameter would have to be replaced by a hot air engine with cylinders 15ft. or 16ft. in diameter. Nor could the new motor depend for its action on the evaporation of volatile liquids. All the available fluids more volatile than water gave off an inflammable or poisonous vapour, which was so subtle that no known joints could prevent its escape. Du Tremblay had tried ether, but the engineers had been compelled to use safety lamps in the engine-room, and had worked in hourly risk of their lives. His scheme had been tried in three or four ships, but although it had been claimed to save 70 per cent. in the fuel bill, it had been a failure. The steam engine, we concluded, was safe from rivalry. Mr. Bourne had sacrificed sound sense for sounding phrases. We called upon him to retract a statement which was likely enough to lead young inventors on a will-o'-the-wisp chase. We need only add by way of comment, that we mentioned neither the gas engine nor the oil engine as inventions likely to fulfil Mr. Bourne's prophecy, although both types of internal combustion engine were then engaging the attention of experimenters and inventors.

A CLEANING shed for the Southern Railway with over 145,000 square feet of floor space is now nearing completion at Victoria, on the site of the old Victoria Basin. During the summer season it is anticipated that over thirty trains daily will receive attention in this shed, and they will enter and leave on a sleeperless railway track, the rails being embedded directly on to a concrete floor. The thickness of the concrete under the rails is 12in. to 14in., whilst the concrete for the remainder of the floor is 4in. to 5in. thick.

2250 kVA., 6000-VOLT TURBO-GENERATOR

ALLGEMEINE ELECTRICITÄTS GESELLSCHAFT, BERLIN, ENGINEERS

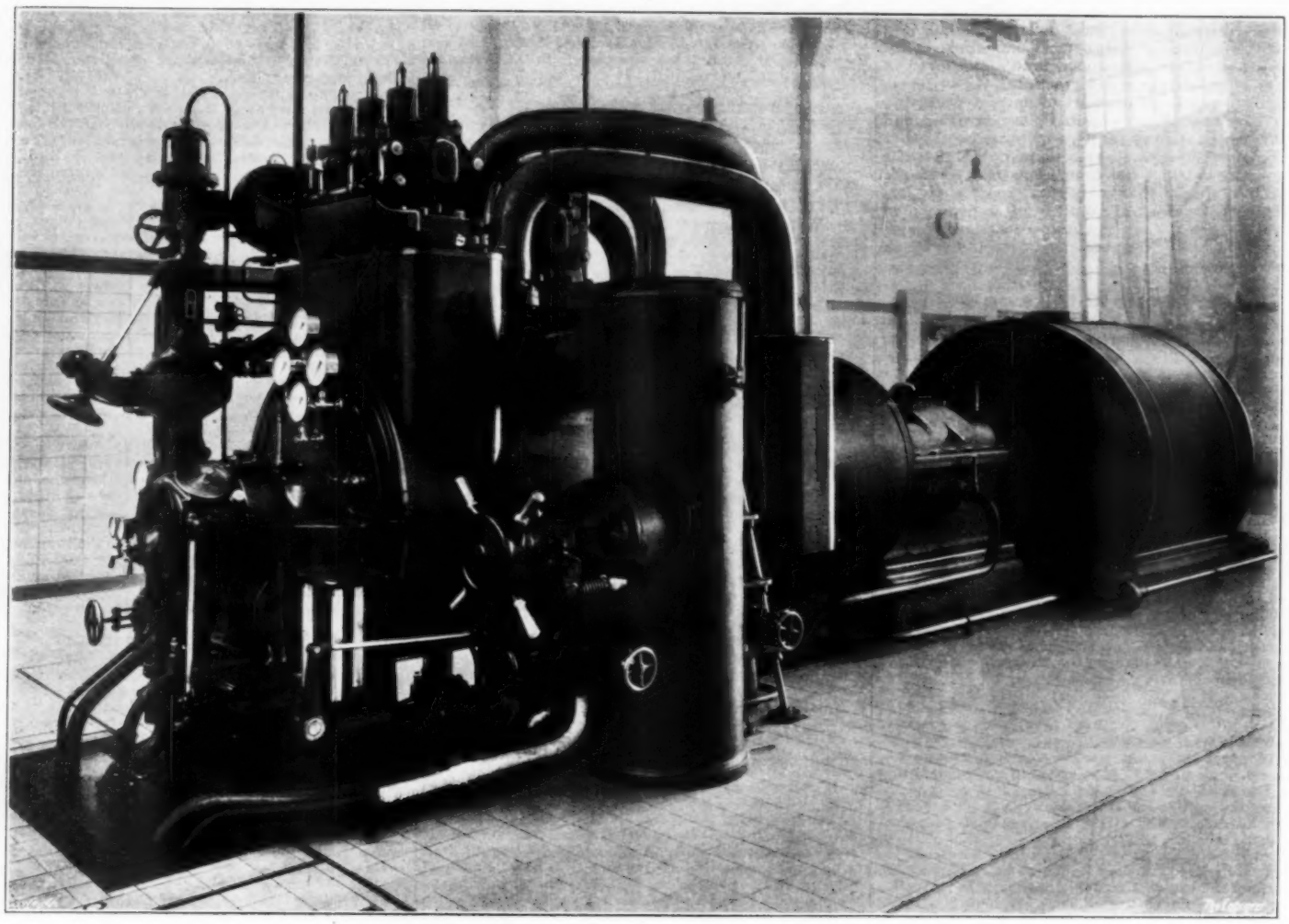


FIG. 1

The Reorganisation of an Industrial Power Plant.

IT is satisfactory to observe that the improvements which have taken place in the design and operation of central station machinery are now beginning to make their effect felt in the private plants which serve industrial undertakings. The factory power plant, by reason of its smaller size and intermittent conditions of working, may perhaps never aspire to all the refinements warranted by central station conditions, but it often possesses, especially when heat is wanted in addition to power, possibilities of economy which it is culpable to neglect. Since, however, power plant operation is not the primary interest of the average factory manager, the spur to improvement must come, in general, from those firms which specialise in power production, and when the latter add the force of example to that of precept, they are likely to reap a double benefit from their enterprise.

Such an example has recently been set by the Allgemeine Electricitäts Gesellschaft of Berlin, in connection with the reorganisation of the power plant at its large transformer factory. This factory was served, until recently, by three boilers, delivering steam at a pressure of 185 lb., and a temperature of 250 deg. Cent. The works required steam at 170 lb. pressure for the wood impregnators, for insulation manufacture and for sundry minor duties. About 10 tons of steam per hour were normally required for these purposes, though the demand might fluctuate between 6 and 15 tons per hour. On the same steam range, was a condensing turbo-generator of about 500-kW capacity and a turbine-driven boiler feed pump. There was a second steam range working at about 30 lb. pressure, from which steam was taken for general heating and drying purposes in the works and stores, and for various oil driers. The demand on this range was subject to great fluctuation. During the winter about 15·5 tons per hour were normally required, though the demand might be as high as 18·5 tons or as low as 10 tons. In the summer the maximum demand was about 6·5 tons and the minimum 4 tons, the mean being about 5 tons of steam per hour. This low-pressure range also supplied steam for the feed-water purifiers. Considerably more power was wanted than that supplied by the steam turbine, and the balance was purchased from the city of Berlin supply.

This brief sketch of the conditions is sufficient to show that they were by no means abnormally bad, being, in fact, fairly typical of those obtaining in many well-managed factories. It was realised by the company, however, that great economies might be made by modernising the plant and generating the power which was purchased, from the steam before the latter was used for heating. To this end it was decided to raise the steam pressure to 470 lb. and the temperature to 415 deg. Cent. Two new boilers were therefore installed. They are fired with pulverised fuel, and have a united capacity of 19 tons of steam per hour at the above pressure and temperature. A new steam turbine was also constructed by the Allgemeine Electricitäts Gesellschaft to meet the special conditions. This turbine is of the two-cylinder pass-out back-pressure type. It is designed to take a maximum of 17 tons of steam per hour at a pressure of 430 lb. and a temperature of 400 deg. Cent. at the stop valve. Of this steam a maximum of 6 tons per hour at a pressure of 170 lb. can be tapped off at the end of the high-pressure cylinder. The remainder does further work in the low-pressure cylinder, from which it is exhausted at a pressure of about 30 lb. into the low-pressure heating mains. In order to meet emergency demands for heating steam, and the heavy requirements possible in winter, automatic reducing valves are provided between the 470 lb. and the 170 lb. mains, and again between the latter and the 30 lb. mains. The original boilers are also available in case of need.

The appearance of the new turbo-generator, as erected in the engine-room, is illustrated in Fig. 1, and the general design of the turbine is shown by the sectional drawing reproduced in Fig. 2. The generator produces current at 6000 volts and 50 cycles, and is rated at 2250 kVA, with 70 per cent. power factor. It runs at 3000 revolutions per minute, but as that speed would have been undesirably low for the turbine, in view of the density of the steam, the turbine runs at 7000 revolutions per minute and drives the generator through gearing. Both the high-pressure and the low-pressure cylinder have nozzle group governing, the entering steam acting first on a two-row velocity-compounded wheel of 320 mm. diameter on each rotor. Each velocity-compounded wheel is followed by a drum furnished with fourteen rows of reaction blading, the mean diameter of this blading increasing from 228 mm. to 241 mm. in the high-pressure cylinder, and from 290·5 mm. to 315 mm. in the low-pressure cylinder. The high-pressure cylinder casing illustrated in Fig. 3 is of cast steel, and has no joint except, of course, on the horizontal diameter. The guide blades are fastened in an inserted steel liner, which is surrounded by steam, and therefore expands proportionally with the rotor. In the low-pressure casing, because of the lower steam temperature, the inserted liner has been omitted, the guide blades being fixed directly in the casing. The exhaust end is cast separately from the casing, and bolted to the latter with a circumferential flanged joint.

In order to balance the axial thrusts due to the reaction blading, both cylinders are arranged with their inlet ends adjacent, so that the steam flows through them in opposite directions. To take care of any residual thrust which may exist, a double thrust ring is provided, details of which are given in Fig. 5. This is contained in the front bearing of the low-pressure rotor. The eight separate segments which take the thrust on each side are supported in such a way that they can tilt and so facilitate the entrance of the lubricating oil on the principle associated with the name of Michell. As the whole of the thrust bearing is carried on the steps of the running bearing, which are themselves held in spherical seatings, any deflection of the shaft which may occur cannot interfere with the equal distribution of pressure on the thrust collar, the pressure surfaces always remaining normal to the axis of the shaft.

The speed of the turbine is controlled by a centrifugal governor, whose special function it is so to regulate the pass-out steam, that any desired quantity of steam up to the whole amount entering the turbine can be expanded down to 30 lb. pressure, the pressures of the live steam, pass-out steam and exhaust steam being kept constant. Live steam enters the high-pressure cylinder through three valves, the seating of one of these being shown in Fig. 2. After having done its work in this cylinder, a part of it passes out to the 170 lb. heating system, and the remainder flows to the inlet end of the low-pressure cylinder through four overhead pipes, the entrance to these pipes being controlled by the four valves seen on top of the turbine in Fig. 1. The principle of the governing is as follows :—Live steam is admitted to the high-pressure turbine, and 170 lb. steam to the low-pressure turbine by the raising of two vertical links, which are attached at their lower ends to a

2250 kVA. TWO-CYLINDER, PASS-OUT BACK PRESSURE TURBINE

ALLGEMEINE ELECTRICITÄTS GESELLSCHAFT, BERLIN, ENGINEERS

(For description see opposite page)

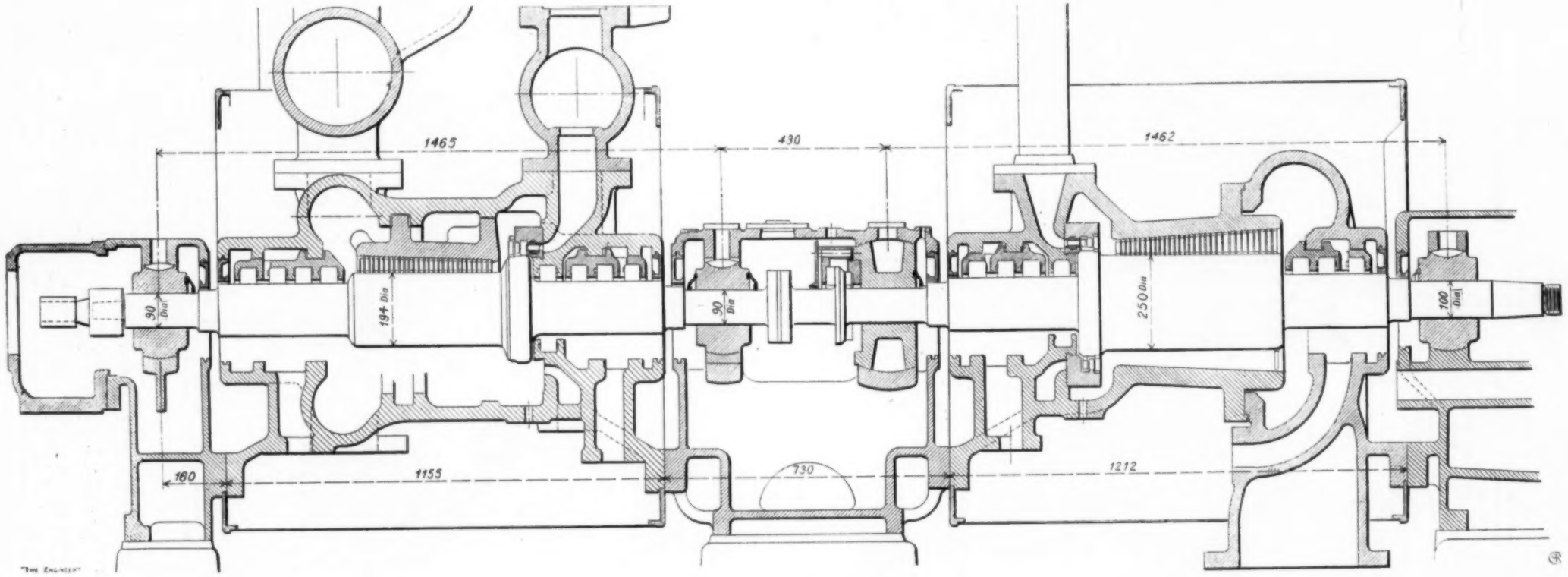


FIG. 2—LONGITUDINAL SECTION

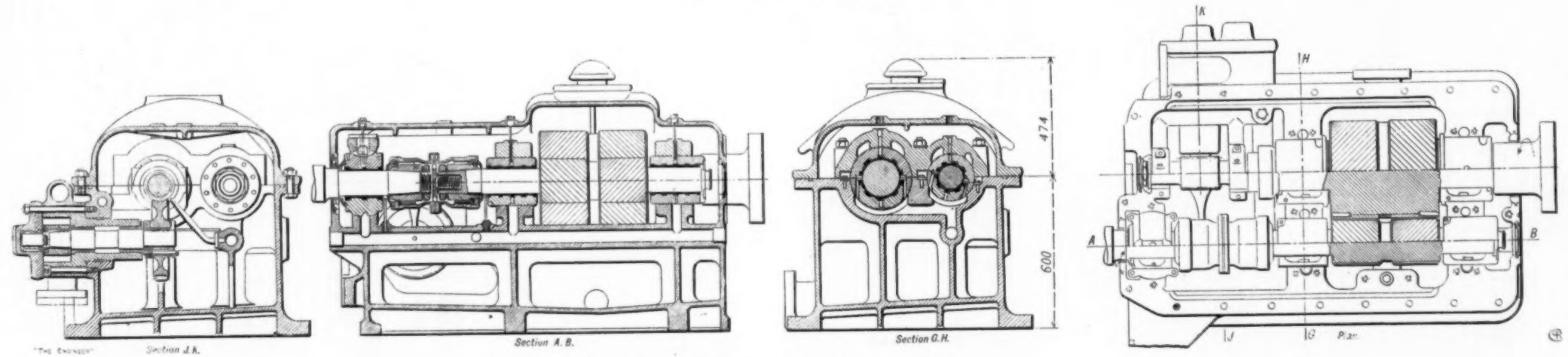


FIG. 3—ARRANGEMENT OF REDUCTION GEARING

horizontal lever. One end of this lever is extended and attached by a third vertical link to a spring-balanced piston, the position of which is determined by the steam pressure in the high-pressure heating mains. A fourth vertical link jointed to the lever between the two links first mentioned, is raised by the governor as the speed of the turbine drops. A little consideration of such a linkage will make clear the action. Suppose, for example, that the load on the turbine increases. The consequent fall in speed causes the governor to lift the horizontal lever, which turns

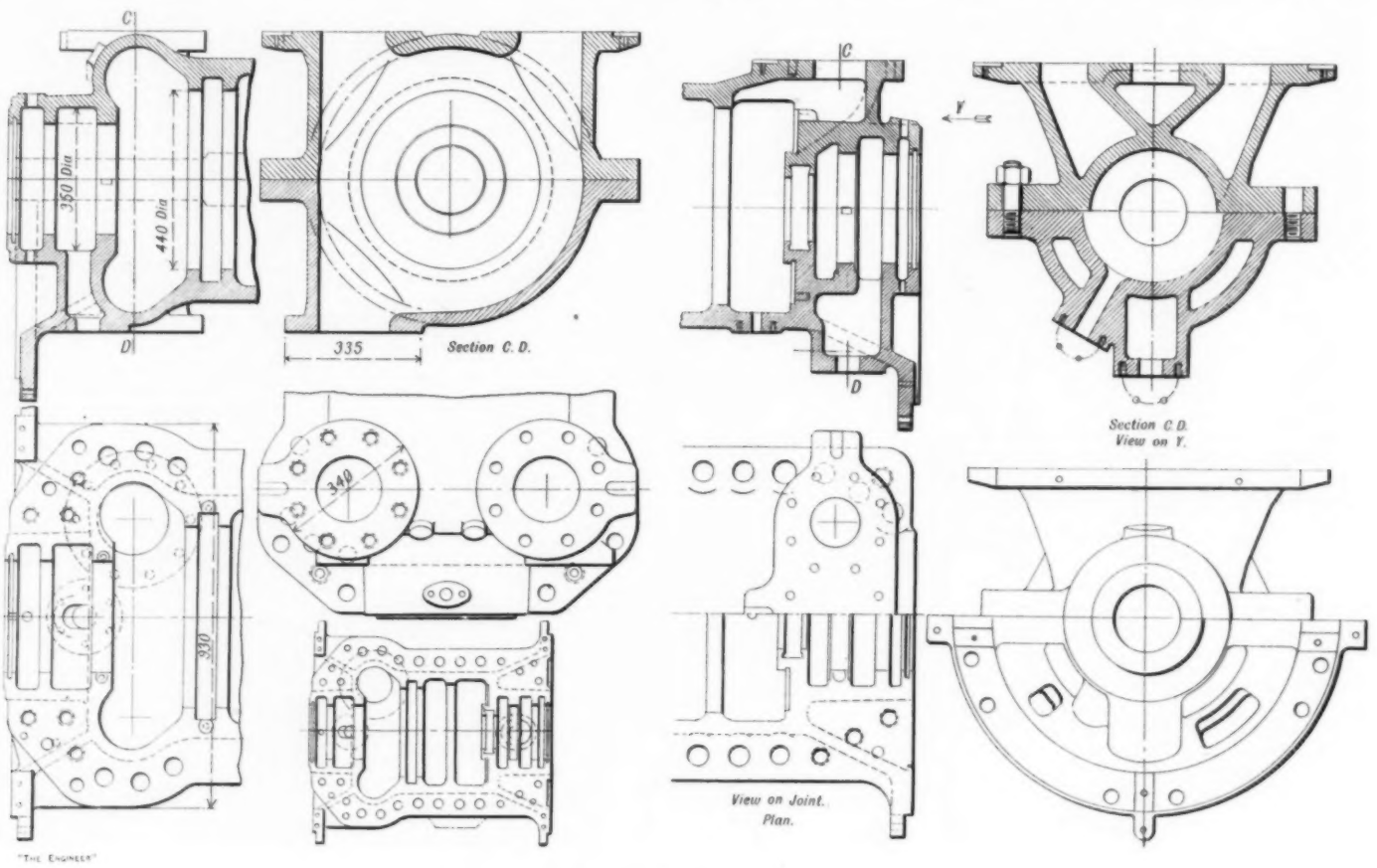


FIG. 4—HIGH-PRESSURE CASING

about the end to which the spring-balanced piston is attached. The rise of the lever opens both the live steam admission valve and the pass-out valve. Should the extra opening of the latter cause a rise in pressure in the high-pressure heating mains, the spring-balanced piston descends a little, and the horizontal lever fulcrums around the governor connection, closing the pass-out valve a little and opening the steam admission valve a little more.

Both the turbine rotors are rigidly coupled together, but the connection between the low-pressure rotor and the gearing is formed by a flexible coupling of the

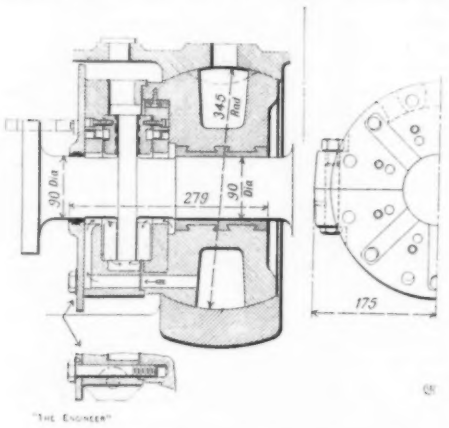


FIG. 5—THRUST RING AND BEARINGS

claw and sleeve type, as shown in Fig. 3. This latter coupling allows a small play axially between the coupled shaft, and at the same time permits of a limited radial displacement. The gearing is of the single reduction type, with double helical teeth cut at an angle of 45 deg., with the axes of the wheels. The pinion is solid with its shaft, but the wheel consists of a toothed ring shrunk on to a solid drum. The wheel is held against any endwise movement, but the pinion is free to adjust itself axially to equalise the pressure on the teeth. To lubricate the gear, oil is sprayed against the teeth along the line of engagement in the usual manner, Fig. 6. The whole machine is equipped with forced lubrication. For the oil supply there are two gear pumps, having a combined capacity of about 425 litres per minute. One of these is contained in the front pedestal of the high-pressure turbine, and the other is driven by worm gear from the low-speed shaft of the reduction gear. The pumps take their oil from two reservoirs, which are connected together by equalising pipes, and deliver it through a common oil cooler to the general oil system which serves for the governing and the lubrication of the turbine and generator bearings and the gear. The oil pressure for the governor gear is 70 lb. per square inch, and about 7 lb. per square inch for lubrication.

The steam consumption of the turbine at various loads when working against a back pressure of 30 lb., and when no steam is being passed out, is given by the following table :—

Load. kW.	Steam consumption, lb./kWH.
1570	23·76
1400	22·66
1280	23·98
785	27·72

When 10 tons of steam per hour at a pressure of

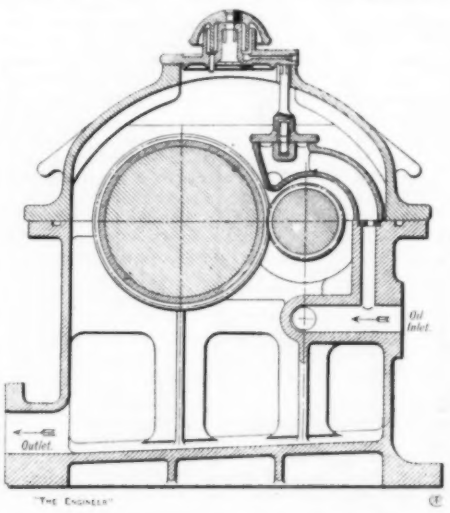


FIG. 6—GEAR LUBRICATION SYSTEM

170 lb. are being passed out of the turbine, the latter will produce about 630 kW with a total admission of 15 tons of steam per hour. When 10 tons of steam are admitted and 6 tons per hour passed out, the power developed is about 150 kW. By the operation of this unit, the A.E.G. transformer factory is not only supplied with all the heat wanted for various purposes, but since the whole of the steam so used serves to generate power before entering the heating mains, a considerable quantity of power is obtained at a negligible cost. The system is one which deserves serious consideration in the case of all factories where steam is required for heating or process work.

Hydro-Electric Power in the Punjab.

THE Punjab is a province in which the extension of dependable irrigation, including the bringing under cultivation of very great tracts of almost barren lands,* is sufficient in itself to bring about important industrial and commercial developments. There is now being brought into play another factor of very great significance in respect of the future prosperity of the province. Hydro-electric power is to be supplied, not only to the towns, for municipal and industrial purposes, but also to rural areas, for the pumping of irrigation water from bore-wells and for the drainage of water-logged lands. Within the Punjab and adjacent States nearly 2½ million horse-power is available in falls most of which can be economically utilised. Two million horse-power is equivalent to more than half the output of all the coalfields of India at the present time. A report of the survey upon which the estimate of available power is based contains an addendum in which a programme of works for the next twenty years is proposed. The first item is the completion of the Uhl River project, in Mandi State, which will provide for the supply of the eastern half of the province for a generation. A site on the Haro, near Campbellpur, could supply power for the northern end of the Punjab and the North-West Frontier Province. The first stage would be completed by works to utilise the power available on the canal fall near Rasul and that on the Swat River near Malakand.

THE MANDI HYDRO-ELECTRIC PROJECT.

A report on the possibilities of utilising hydro-electric power within a large bend of the river Sutlej was received in 1921, but the scheme has been postponed in favour of the Uhl River project, in Mandi State. The site for this station was discovered in June, 1922, and it is regarded as much superior to any other so far found. The project is described and the results which will follow the carrying out of the works are explained in a pamphlet of the Hydro-electric Circle of the Punjab Public Works Department. The site was surveyed in the winter of 1922–1923, and the detailed project was completed in the following December. It has been subjected to exhaustive scrutiny by a committee, and, in its several aspects, by exceptionally qualified engineers.

The catchment, in the basin of the Uhl, a tributary of the Beas, is 250 square miles in area and is in a region in which the streams are fed by melting snow. The total available fall from the diversion works, which are at an altitude of 6000ft., is 3750ft. The water (eventually to be stored by the building of a dam at an excellent site), will be diverted through 2½ miles of 9ft. tunnel in solid granite to a point whence a fall of 1800ft. is obtained, to the first power station. Here the installation of a plant of 36,000 kilowatts can be supplied with sufficient water power from the natural flow, while, after the dam above referred to has been built, the plant can be increased to 70,600 kilowatts. The tail-water from this station will pass in an open channel, 3 miles long, to a point from which

* THE ENGINEER, February 17th, 1928. Sutlej Valley Project.

a fall of 1200ft. will serve a station of 48,000 kilowatts, this power being available after the dam has been built. Thus there will so far be available 118,600 kilowatts, which can eventually be increased by utilising a further fall of 750ft. Without this third resource the project will suffice to meet the needs of the present generation in an area extending from Delhi in the south to Sialkot and Lyallpur in the north.

A Railway Project Involved.

There is at the present time sufficient demand for power to justify the carrying out of the first stage of the scheme, now in hand. Promises made by prospective users of current suffice to ensure that the annual expenses will be met for the first five years.

The works involve the construction of a metre gauge tramway from the existing railhead at Mukerian, serving the Kangra Valley, which has for many years been in need of improved communications. It is estimated that the tramway will pay a return on about 66 per cent. of its capital cost. It has therefore been decided that after the completion of the power works it shall be opened for goods and passenger traffic, the power project being debited with 33 per cent. of its capital cost.

Including, in the first instance, the whole cost of constructing this line, as well as the provision of a fund to assist millowners to instal electrical equipment on the hire-purchase system, the capital cost of the project to the end of the first stage, with the first power station in service, is estimated at 557 lakhs.

The Area of Supply.

It is expected that those works will be completed by the summer of 1929, when power will be available at some twenty towns in the Punjab and at three in Indian States. The average price per unit will probably be about 9 pies, or Rs. 157 per kilowatt-year. This relation implies that the basis of computation is a sixteen-hour day. The twenty-three towns, served by the works of this first stage, will include:—Dhariwal, Amritsar, Lahore, Lyallpur, Ferozepur, Beas, and Baghbanpura, all in the Punjab, and in Indian States, Mandi, Kapurthala, and Phagwara. In the second stage of development, following the building of the dam and the increase of the plant to 70,600 kilowatts, the supply will be extended to Simla, Ambala, Patiala, Gujranwala, and Sialkot. Eventually the number of towns served will be more than sixty, and will include Kasauli, Delhi, Meerut, Roorkee, and Panipet.

The extra cost of transmission, owing to the location of the power stations in the foothills, is only 5 per cent. of the total cost of the project. After the scheme is on a paying footing, the Raja of Mandi will receive royalties, rising from R. 1 to Rs. 3¼ per kilowatt-year.

It is believed that agriculture will eventually be the chief user of the power. Tube-well irrigation will be made economically possible, probably not costing more than Rs. 22 per acre per annum, possibly less. Some 2½ million acres may be eventually irrigated by this means, while 50,000 acres of lands now water-logged can, it is believed, be drained and the water utilised. Further, the project includes the supply of fertiliser, surplus power being available for the production of ammonium sulphate at the estimated price of Rs. 5 per maund.

The project seems likely, therefore, to give so great an impetus to developments in the Punjab that a future of great prosperity may be looked for in that province and in some adjoining areas.

South African Engineering Notes.

Ermelo Torbanite.

After many attempts the Premier African Torbanite Syndicate is proceeding to start operations. A German expert had made an unfavourable report based on a geological error. He put down a number of bore-holes but failed to locate the torbanite, as they were not continued to the requisite depth. A fault had curiously caused a displacement of exactly 60ft., which represents the vertical distance between the torbanite bed and an overlying valueless shale and coal bed, known as the Bamboo Seam. The Syndicate has now proved the report wrong by sinking bore-holes and opening the true torbanite seam 60ft. below the Bamboo horizon.

A noted authority, Mr. E. H. Cunningham-Graham, B.A., F.G.S., investigated the occurrence for the Union Government about fifteen years ago, and reported most favourably. In his latest report, made in 1923, he deals with the tonnage available as follows:—"(*a*) Tonnage of torbanite, certain 8,000,000; (*b*) tonnage of torbanite, probable 20,000,000." The torbanite has been analysed from bulk samples by Messrs. Sulman and Piccard, London; Messrs. Corran and Spence, Glasgow; and Dr. Krey, Riebeck Montan Works, Germany. The first-mentioned firm reported:—Motor spirit, ·730 specific gravity, 5·4 per cent. = 8·2 gallons; burning oil, ·811 specific gravity, 32·3 per cent. = 48·4 gallons; middle oil, ·850 specific gravity, 15·9 per cent. = 24·4 gallons; total, 96·4 gallons per ton. The German analysis was:—Benzol, 17 gallons; paraffin oil, 46 gallons; Diesel oil, 38 gallons; total, 101 gallons. Messrs. Corran and Spence made the total 103·3 gallons per ton of torbanite, and Dr. E. Menfeld, Johannesburg, found an average of 97 gallons of crude oil per ton. Thirty tons of torbanite shipped to London and treated in a Tozer retort yielded 90 gallons per ton at Battersea. Mr. G. A. Troye, consulting mining engineer, from a series of twenty-one bore-holes and eleven surface exposures, one of them having tunnelled 214ft., with 90ft. of cross driving, arrives at the conclusion that the geological horizon of the torbanite north of Ermelo (Transvaal) is distributed over 8000 morgen (over 16,000 acres), with a thickness varying from 10in. to 24in. He estimates the total quantity of torbanite in the Ermelo area at over 26,000,000 tons.

Victoria Falls Power Concession.

The Northern Rhodesian Legislative Council has now definitely claimed that the concession granted to the Victoria Falls Power Company is invalid, the main fact relied upon appearing to be that the concession was not registered at the deed office, Livingstone.

On April 18th last, in the Legislative Council, Mr. L. R. Moore moved that the Government should take into consideration utilisation of the power to be derived from Victoria Falls, and the best means of promoting its exploitation in the immediate future. Mr. Moore, in the course of his speech in support, explained that, soon after the British South African Company came to that part of the world, several of the directors formed themselves into a syndicate, known as the African Concession Syndicate, and took to themselves the right of disposing of, or otherwise using, the power of the Victoria Falls. They subsequently sold the concession to the Victoria Falls Power Company, the consideration being £1,120,000, payable £120,000 cash and £1,000,000 fully paid ordinary £1 shares. Under the concession the company acquired the right to develop 250,000 H.P. at the Falls and the exclusive right to deliver power from the Falls to the Transvaal. The company has never exercised its right, on the ground that the Rand was too far away to make the delivery of power from the Zambesi a feasible undertaking, and that there was not sufficient demand for power any nearer the great river.

The area of the concession is defined as from a point on Livingstone Island to the mainland, having a radius of five miles. The reason why the present town of Livingstone is situated where it is is because it was not deemed expedient that it should be within that area.

Mr. Moore, in his speech, urged that it would be possible to electrify a portion at least of the railways, and that, as there would be bound to be a surplus, it could be used for local enterprises, which would thus be encouraged to develop. The object of his motion was, he said, to make an investigation into the legal position, and to take steps to induce some powerful company either to exploit this business or to permit some other person, not so powerful, to use the power if he could do so at a profit. He believed that there would be plenty of applicants.

The Chief Secretary, speaking for the Government, said that it would lend a willing ear to any proposition put forward to develop the power of the Victoria Falls. He understood that the Governor intended to go into the question of making known more widely to the world that the resources of power from the Victoria Falls are available for use. The Government considered that it was open to consider any offer which might be made, and regarded itself at full liberty to do so.

The President of the Council stated that the Government was quite prepared to accept the motion, which was then agreed to. The Victoria Falls Power Company stated that it had no intention of parting with its rights, and will have recourse to the law courts and carry the case, if necessary, to the Privy Council. The company also claims that with the great development taking place in Northern Rhodesia the position is so changed that the company is even now considering a scheme for supplying that country with power.

A State Steel Company.

Under a proclamation in the Union *Gazette* of Friday, June 1st, it is declared that "there shall be constituted and incorporated on June 5th, 1928, a company under the name of the South African Iron and Steel Industrial Corporation, Ltd., with the powers and objects set forth in the Act recently passed by Parliament." This company is, of course, the State-controlled concern, details of which have been previously given. There are intriguing elements in connection with this enterprise. An outside estimate of the iron and steel requirements of the Union is 150,000 tons per annum, and the new works proposes to supply at least 130,000 tons. Professor Stanley has estimated that among the requirements of the Union are:—Rails, crossings, &c., for railways, 65,000 tons; rails for the mines, 12,500 tons; angles and channels, 5000 tons; bar, bolt and rod, 21,000 tons; girders, beams and columns, 8000 tons; plate and sheet, 10,000 tons; bolt, nuts and washers, 2500 tons; fencing standards, 25,000 tons; drill steel, 6000 tons; shoes and dies, 7500 tons; steel castings, 2500 tons; and in addition 10,000 tons of pig iron. These he considers could be produced in a steel works of relatively small size. Moreover, this total of 165,000 tons would be considerably increased by the provision of the raw material for the manufacture of a portion of the agricultural, mining and railway machinery, pipes and pipe fittings, galvanised iron and miscellaneous goods. Leaving the latter items out of consideration, it is quite certain that the erection of plants to manufacture a number of the items constituting the 165,000 tons could not possibly be undertaken at any works in South Africa without serious loss, as the plants in many instances would run off in a week or two the Union's requirements as regards those particular commodities for twelve months. The estimates of steel rails for the railways and mines are also certainly excessive and the fencing standards wanted will certainly not exceed 10,000 tons per annum now that the great majority of farms requiring protection from jackals have been fenced. On all the data available it seems certain that the new State works will be able to supply all the needs of the Union beyond such as cannot be economically manufactured. But the Union Steel Corporation is at present producing close on 40,000 tons, the Dunswart Ironworks about 15,000 tons, and certain foundries and engineering works a further 10,000 tons of steel. The Newcastle blast-furnace of the Union Corporation has a capacity of over 60,000 tons per annum at full production. In addition the Union Corporation is even now about to increase its production of steel considerably. Its wire works, with a capacity of, say, 15,000 tons per annum, have been started. The tube and pipe works which Stewarts and Lloyds are erecting in co-operation with the Union Corporation which are to have a capacity of 20,000 tons, will be in operation before long. Very shortly the manufacture of galvanised sheets on a large scale will be begun, while a nut and bolt works is already working. Practically all these enterprises, and others that could be mentioned, are financed from Britain and British firms started them as subsidiary works in South Africa. The new State enterprise will certainly not be ready to start operations for a couple of years, and when it does it will be faced with a well-established and well-equipped rival already producing about 80,000 tons per annum, if not more. It is therefore obvious that it will have to enter into direct competition from the very start with the existing interests unless an agreement is arrived at in the meantime. It is widely felt that the outlook for the State works is not a pleasing one.

THE CARTOGRAPHY OF THE EMPIRE.

An exhibit of maps illustrating the cartography of the Empire has been prepared by the Science Museum in connection with the International Congress of Geography, which meets in London this month, and the Conference of Directors of Survey in the Dominions and Colonies, which held its first meeting at the Colonial Office on Monday of this week, July 2nd. The exhibit affords an opportunity for all those concerned with Imperial affairs to see examples of the various types of map which are in use to-day. The Hydrographical Department of the Admiralty is exhibiting an interesting series of modern charts, as well as a number of early charts dating from the eighteenth century. The Geographical Section of the General Staff, War Office, has rendered much assistance in obtaining from the Dominion and Colonial Surveys a representative collection of their publications, and has also lent for exhibition interesting specimens of its own topographical surveys in various parts of the world. A series of maps of Great Britain is shown by the Ordnance Survey and another of Indian Maps by the Survey of India. The collection also includes types of the maps which are being produced by Canada, Australia, New Zealand, and South Africa. There are also selected examples from British Guiana, British Honduras, Ceylon, Federated Malay States, Fiji Islands, Gold Coast, Hong Kong, Mauritius, Nigeria, Palestine, Trinidad and Uganda.

P. D. DONALD.

It is with regret that we have to record the death o Mr. Patrick Dunlop Donald, the chief engineer to the Clyde Navigation Trust, which took place in Glasgow on Tuesday last, July 3rd. Mr. Donald, who was in his sixtieth year, received his technical training at the University of Glasgow, and after graduation he became a pupil of Mr. John Strain, of Glasgow. Three years were afterwards spent as assistant engineer with Messrs. Strain and Robertson, consulting engineers, of Glasgow, during which period he acted as a resident engineer for the Ardrossan Harbour extensions, and on railway work near Edinburgh. He also spent two years on preliminary work connected with a water scheme for Edinburgh. Prior to his joining the Clyde Trust in 1903, Mr. Donald spent six years on railway work in the Federated Malay States. From 1903 until 1913 he was the leading office assistant to Mr. W. M. Alston, who was then chief engineer to the Trust, and in 1913 he was appointed assistant to the chief engineer, becoming the chief engineer in succession to Mr. Alston five years later. His most important work with the Clyde Navigation Trust was the preparation of the plans for the dock extensions at Shieldhall, which work has been carried out under his personal supervision. He joined the Institution of Civil Engineers in 1894, and was elected a member in January, 1919.

CATALOGUES.

C. S. Milne and Co., Ltd., Octavius-street, S.E. 8.—"The Milne Book of Welding and Cutting."

Sulzer Brothers, 31, Bedford-square, W.C. 1.—Pamphlet on Maag gears, showing the various types of drives supplied.

The British Thomson-Houston Company, Ltd., Rugby.—Descriptive list No. 5030 of electric control gear for mines and quarries.

C. R. Garrard, 11, Duke-street, London Bridge, S.E. 1.—A leaflet describing the "Garrard" patent infinitely variable and positive gear.

Gent and Co., Ltd., Faraday Works, Leicester.—Book 7, Section 6, dealing with the "Pul-Syn-Etic" idle machine and output recorders.

Yorkshire Electric Power Company, 36, Park-place, Leeds.—A pamphlet on "Electricity for Water Pumping, Sewerage and Drainage Purposes."

Thomas Broadbent and Sons, Ltd., Central Ironworks, Huddersfield.—A booklet dealing in detail with "Broadbent" centrifugal clutches.

Hans Renold, Ltd., Didsbury, Manchester.—A recent publication on conveying and elevating chains—illustrating many typical illustrations.

Petters (Ipswich), Ltd., Ipswich.—A catalogue illustrating and describing surface ignition heavy oil engines ranging in powers from 22½ to 90 B.H.P.

John Birch and Co., Ltd., 2, London Wall-buildings, London, E.C. 2.—Pamphlet illustrating various lifting and transporting appliances stocked by the firm.

Harland Engineering Company, Ltd., 196, Greengate, Manchester.—Catalogue X. 63/282, giving full particulars of low-tension air-break switchgear.

The British Steel Filing Company, Ltd., 54a, Parliament-street, S.W. 1.—A booklet describing in detail the "Vibro" system of casting concrete piles *in situ*.

The Bristol Aeroplane Company, Ltd., Filton House, Bristol.—A brochure giving particulars of the design and construction of the "Bristol" Jupiter aero-engine.

Frost Brothers, 104, Victoria-street, S.W. 1.—Folder giving particulars of "Haveg," a phenol-formaldehyde condensation product of the well-known Bakelite class.

Midland Electric Manufacturing Company, Ltd., Birmingham.—A sectional list dealing with ironclad cut-outs from 15 to 200 ampères for pressures up to 500 volts.

The Woodall-Duckham Companies, Allington House, Victoria-street, S.W. 1.—A brochure entitled "The Woodall-Duckham System of Intermittent Vertical Chambers."

J. and H. McLaren, Ltd., Midland Engine Works, Leeds.—Catalogue No. 58, "The McLaren-Benz (M.W.M.) Diesel Oil Engines, Stationary and Marine." Catalogue No. 60, "The McLaren-Benz Light-weight High-speed Diesel Oil Engines (M.D.B. Type)."

Letters to the Editor.

(We do not hold ourselves responsible for the opinions of our correspondents.)

SAFETY RAZOR BLADES.

SIR,—I have read with keen interest Mr. Kayser's valuable article on "Safety Razor Blades," in your issue of June 8th. Very few papers on this subject have been

FIG. 1 FIG. 2

published, although undoubtedly a considerable volume of work has been done. One is led to conclude that the results obtained are treasured in secret archives under treble lock and key—a fact greatly to be deplored. The

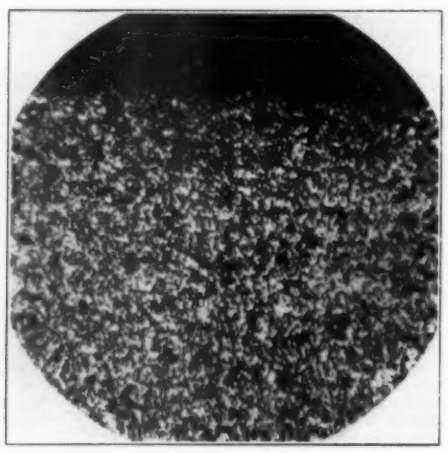


FIG. 3

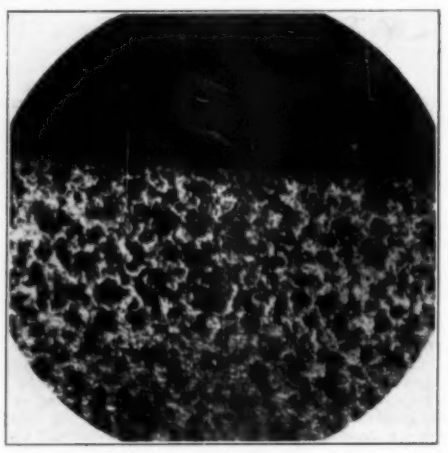


FIG. 4

dissemination of scientific knowledge is the best and surest way of making further progress. Mr. Kayser will be the last to dispute this statement, and, I feel sure, any remarks of mine on his article will be regarded by him, not as adverse criticism, but rather as a slight contribution to the sum total of the published knowledge on the subject.

I can most heartily endorse Mr. Kayser's warning about the fictitious microscopical results obtained through improper mounting of razor blades. Memories of much wasted time, sadly worn patience, and tearing of hair over discordant results lead me to emphasise his warning. Ease of control in mounting is well worth the trouble and expense incurred by making adjustable mounting devices specially suited for the subject under examination. A little thought, and, if necessary, a short consultation with a draughtsman will soon yield a sketch of a suitable mount which can be made for a few shillings.

Mr. Kayser states that the methods of producing an edge may usually be divided into three operations :—

(1) Rough grinding on an emery wheel.
(2) Fine grinding on an emery wheel or on steel rolls.
(3) Stropping.

I would remind him of a fourth method which is equally important—honing on a flat hone, followed by stropping.

There is a well-known type of safety razor on the market with a hollow-ground blade, the edge of which is produced and maintained in this way. The honing is done in the correct heel-and-toe fashion, the back and front edges of the blade bearing on the hone. This process produces an edge as sketched in Fig. 1. The final stropping on a special strop rounds off the tip of this edge, giving the effect shown in Fig. 2. This figure is comparable with Fig. 3 in Mr. Kayser's paper. This method yields a very satisfactory shaving edge, as the blade has the requisite strength at the extreme cutting edge, owing to the increased cutting angle, without losing the flexibility given by the hollow grinding. Apart from safety razor blades, this is the process used in re-setting the "cut-throat" or open type of razor, and as such is of general interest.

In dealing with the micro-structure of blades, Mr. Kayser gives three micrographs, Nos. 20, 21, and 22. To prepare a blade for etching it is customary to polish the edge to eliminate all scratches, and then to immerse it in a suitable etching medium. This polishing generally has a bad effect on the edge, very often turning it over. From the micrographs it is not definitely clear whether the blades have been polished before etching or not. Parallel scratches at right angles to the edge are still visible in all three micrographs. If the blades have been polished, it is not fair to draw conclusions about their shaving qualities from the shape of the edges, and, if not polished, but simply etched, apart from marring the micro-structure, it is still hardly fair to draw conclusions about a blade, the delicate edge of which has been in a corrosive fluid for at least one minute. The better plan, in my opinion, is to photograph the edge first then polish and etch. If any further shaving tests are needed, a new edge should be produced on the blade.

The micro-structure of plain carbon steel blades varies very greatly indeed, not only in different makes of blades, but also in blades made from the same formula in presumably the same way. Compare micrographs, Figs. 3 and 4, at 200 diameters, of two blades from the same batch known to be made by the same process, of equal hardness, and of equally good results as regards shaving. In one we have a dispersed structure of cementite, whereas in the other a definite cementite network can be plainly seen. The difference in structure is ascribable to, perhaps, slight differences in the temperature at which the steel was worked. So far as the writer's experience goes, it is impossible to dogmatise about the correct structure of a carbon steel blade.

With high alloy steels special etching fluids are very often necessary. With blades containing chromium and cobalt very good etching results are obtained with a freshly prepared solution containing 10 per cent. by volume of hydrochloric acid (conc.) and 10 per cent. by weight of ammonium persulphate. Sometimes valuable results are obtained by polishing in relief. Compare micrographs—Figs. 5, 6 and 7—all of the same chromium cobalt blade at 200 magnification. Fig. 5 shows hard areas standing out in relief. Fig. 6, etched for ten minutes in 10 per cent. nitric acid, as mentioned by Mr. Kayser, shows globular cementite in a structureless ground mass. Fig. 7, etched for 30 seconds in the etching medium recommended above, reveals the structure to a much greater extent.

There is one more point on which I would like to touch before concluding, and that is the shape of the edge at high magnifications. To quote Mr. Kayser: "Without exception, good safety razor blades exhibit a perfect edge at 400 diameters." This is a very broad and sweeping statement, and, if it were true, would be an extremely valuable generalisation. I have had blades within the range of hardness specified showing very regular edges at 500 diameters, which would not yield a single comfortable shave. On the other hand, I have had blades, showing extremely irregular edges at 200 diameters, which give perfect shaves time and again.

Consider micrographs—Figs. 8 and 9—at 200 diameters of the same section of a single blade. Fig. 8 shows it before shaving and Fig. 9 after shaving fifteen times. This blade was tested on every type of beard I could find, the user in every case praising it as giving a most comfortable shave. After each shave, the blade was wiped with a soft cloth, washed in absolute alcohol, and then oiled. It was not polished, stropped or honed. The last shave I had with it was as comfortable as the first. Compare the edge before shaving and after fifteen shaves. The difference, if any, is imperceptible. The edge is very far from being perfect, especially when we remember that all irregularities in it would be doubled at 400 diameters.

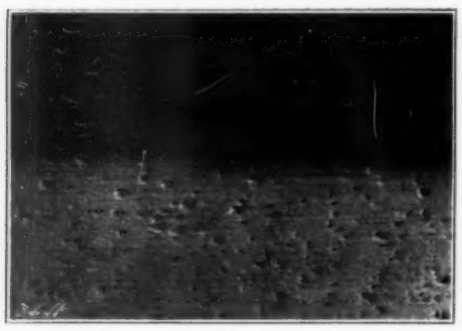


FIG. 5

FIG. 6

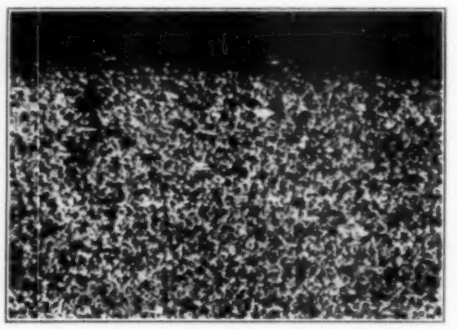


FIG. 7

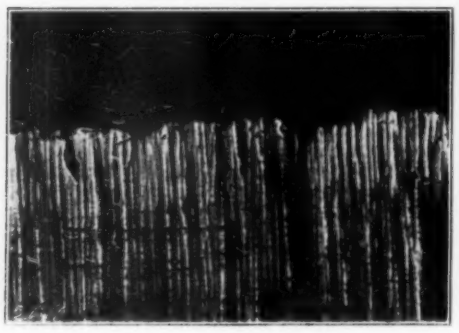


FIG. 8

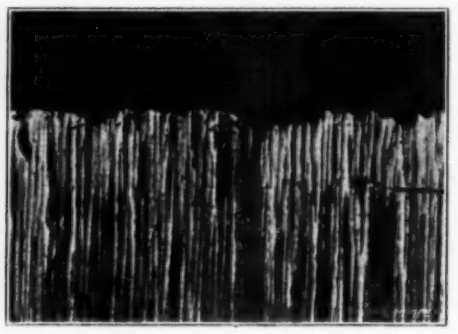


FIG. 9

FIG. 10

This is not an isolated instance. I have had dozens of these in the course of a year. As a matter of comparison I enclose a micrograph at 200 diameters—Fig. 10—of the best blade I have ever encountered. Alas! I was forced to destroy it in the cause of science by cross-sectioning it to obtain its cutting angle.

In conclusion, I wish to say that if these few remarks result

in the publication of new data or the correction of old, I shall feel amply repaid for any little trouble I have had in preparing this note.

H. A. CURRAN, A.I.C., A.R.C. Sc. I.

Cricklewood, N.W. 2,
June 30th.

DERAILMENTS.

SIR,—I read your editorial of June 22nd on railway accidents in South Africa with very much interest, particularly your reference to derailments, and in which you say: "There is a general demand that accidents must cease and that the railways must be made safe for travellers"—a desire all must appreciate.

You make it very plain that derailments are far too numerous. There must be some reason for this, and I venture to say that the wheel flange being the only means of keeping the engine on the rails, its condition should never be neglected.

You also say, it appears that repairs are not in keeping with the work the engines have to do, in a hot country where sand is prevalent and very severe on all parts of the engine, more especially the wheel flanges, which are worn quickly and lose their proper shape, thus becoming dangerous.

I have no hesitation in saying what applies to South Africa applies nearly as much to our home railways. Derailments are more frequent than is generally known. My purpose of bringing the wheel flange to the notice of your readers is because it is the main factor in safe railway travelling.

July 2nd. A. MORRISON.

Provincial Letters.

THE MIDLANDS AND STAFFORDSHIRE.

(From our own Correspondent.)

General Situation.

MIDLAND and Staffordshire iron and steel masters, though still employed far below capacity, are receiving better orders for steel and finished iron. This is almost entirely due, however, to the reduced competition from the Continent, and not to an increase in consumptive demand at home. It is pointed out that although exports of iron and steel improved as the year advanced, and less manufactured goods from abroad have been imported, the home market has not expanded correspondingly. Midland manufacturers continue to exercise great caution with regard to placing forward orders, though many of them realise that increasing production costs abroad are gradually bringing about a closer approximation of selling prices, and that a continuance of that tendency is probable. In many circles it is considered that very cheap continental material in the near future is hardly likely; indeed, native mills should be able, as time goes on, to improve their competitive position. On the other hand, there are numbers of manufacturers, who habitually make use of continental material, who believe that easier foreign prices will come, and for that reason they hold off the market. In the Midlands this week an improvement in the general engineering industry is reported, better specifications and an increased volume of inquiries coming through. Buying of material is spasmodic, and orders are for small tonnages. Consumers on 'Change in Birmingham to-day—Thursday—seemed inclined to await next week's quarterly meeting before purchasing, although producers of iron and steel gave them to understand that no price reductions were likely. Current prices, they maintain, do not, in some instances at any rate, permit of anything more than a meagre balance on the right side. Raw iron, they assert, is being sold at a loss. The outlook in this area is not considered bright, but the market tone, nevertheless, keeps bright, and optimistic industrialists are still to be found.

Steel Demand Improves.

There is an unsteady but improved demand for steel, especially half products, and a number of the local mills are fairly well placed for business. There is no continuity of demand for heavy structural steel. There is an idea prevalent in this area that foreign joists are being used in London, giving an advantage of £1 13s., as against native steel. Delivered in the Midlands, the advantage of foreign steel, at this rate, would only be about £1 4s., and this only for quantities of 50 tons or over. Local structural engineers are none too well placed, and are buying only in small lots. Angles and joists are maintained at £7 17s. 6d., tees £8 17s. 6d., ship, bridge and tank plates £8 12s. 6d., and boiler plates £11. Sales of plates are not very large, but some good orders are expected to be placed at next week's quarterly meeting in Birmingham. Staffordshire steel hoops make £10 10s. at works. Mild steel billets make £6 upwards, and the tendency is for the minimum price to increase. Small bars range from £7 10s. to £8. The strip mills are getting good orders, and values are maintained at the recent level of £7 10s. Wire rods have a firmer tendency, those rolled from imported billets being quoted £8 5s., and those from native raw material £8 12s. 6d. This week German billets have been offered at slightly reduced rates, but little business appears to have been effected in the Midlands.

Pig Iron.

There is no easing of the position in the pig iron department. Demand continues poor, stocks are mounting and values are inclined to go lower. It seems very probable that additional Midland furnaces will be put out of action unless at next week's quarterly meeting ironmasters are assured of improved sales during the coming quarter. Present indications, however, do not point towards the prospect of large forward contracts being placed. Furnacemen are striving hard to prevent a slump in prices, and up to the present have met with a good deal of success. The low price at which one seller has recently been accepting business is no longer acceptable, stocks having been reduced to a more manageable level. Northamptonshire makers' quote No. 3 foundry £2 16s. 6d. to £2 17s., forge £2 13s. 6d.; Derbyshire blast-furnacemen ask £3 1s. to £3 2s. for No. 3 foundry and £2 18s. for forge. It is reported to be still possible to put through business at 6d. to 1s. per ton below these figures, but it is only in exceptional cases and where bulk supplies are the subject of negotiation. Neither the Midland foundries nor forges are well employed, and it would appear their requirements could be met from stock at the furnaces for some little time to come.

Finished Iron.

Though the call for inferior brands of Staffordshire iron is improving, orders for best grade bars for shipbuilding and railway rolling stock requirements are rather scarce. Makers of marked bars are getting just sufficient business to enable them to run the mills with fair regularity, but they have little reserve of orders. The £12 basis is maintained without much difficulty, and it is the considered opinion of ironmasters that new business would not follow a fall in values, the smallness of purchases being due to quietude in the consuming industries. The competition for the Crown bar business continues, and Staffordshire and Lancashire makers who want something in the neighbourhood of £10 for their product see the business go to other outside firms who sell an inferior Crown bar at from £9 2s. 6d. upwards. Very little is heard, however, of Belgian No. 4 iron, which a month or so ago was being freely offered in this district to users of Crown quality iron. Makers of nut and bolt iron maintain their improved position, and have secured some fairly substantial orders just lately. In the case of large tonnages it is reported makers are prepared to shade the recognised price of £8 17s. 6d. Makers of tube strip make good sales, though not quite up to the standard of a few weeks ago, the tube works not being so well employed. The price remains steady at £11 per ton. No large purchases of Belgian No. 3 iron by bolt and nut makers in the Black Country are taking place, but consumers are closely watching the market, some being of opinion that continental quotations will recede before long.

Galvanised Sheets.

Purchases of galvanised sheets have fallen away again this week, the overseas buying spurt having reached its limit, and there being no accession of demand from home buyers. Some Midland mills continue to quote last week's top figure of £13 10s., but the majority have come down to £13 7s. 6d. for 24 gauge corrugateds. The mills are fairly busy, but much more work could be handled if it were available. Early deliveries are procurable.

Scrap.

Sales of heavy scrap continue weighty, and sellers now ask £3 7s. 6d. per ton delivered South Wales as a minimum. In many cases £3 10s. is asked and is reported to have been paid by consumers anxious about supplies. Stocks in merchants' hands are nothing like so heavy as they were, and the advantage at the moment is certainly with the seller.

Birmingham Gas and Electricity Sales.

It was reported to the Birmingham City Council on Tuesday that the gas sold and used on works during the year was a record for the undertaking, the total sales being slightly in excess of 13,581 million cubic feet. The previous record figure was in the year ended March, 1926, when the total sales amounted approximately to 13,390 million cubic feet. The return from residual products shows a marked reduction, notwithstanding the increased quantities available for sale, both coke and ammoniacal liquor being very much reduced in value during the year. Tar was the only residual to yield a higher return last year. Equally satisfactory was the report of the electricity undertaking, which showed that the additional quantity of electrical energy sold, viz., 46¾ million units, established a record, the nearest approach to this figure being 34 million units in 1915–16, during a period of industrial activity on war munitions. The total sales during the year amounted to nearly 281 million units, equal to about 275 units per head of population.

Cannock Chase Coal Losses.

The loss per ton of coal raised in the Cannock Chase coalfield in May was 6·15d., and June's figure of 13·65d., shows an increase of 7½d. on the previous month and 8½d. on the month of April. The deficit on owners' profits now amounts to £1,843,994. The minimum wage for miners in the coalfield will rule again in July. This is 42 per cent. on the 1911 basis, and gives a wage to stallmen of 9s. 4d. per day. The ability of the industry to pay, however, is only 11·96 per cent., which is a decrease of 2·61 per cent. on the previous ascertainment.

Unemployment.

A further rise of 7429 in the number of unemployed persons in the Midlands brings the total to 186,923, of whom 90,515 are temporarily without work. The seriousness of the position may be realised from the fact that at the opening of the year the unemployed in the area numbered 129,573, of whom 47,414 were short-time workers. In the Birmingham area there are 28,052 unemployed, as against 22,119 six months ago. The present total is roughly 4000 in excess of that for last midsummer.

LANCASHIRE.

(From our own Correspondents.)

MANCHESTER.

The Outlook for Engineers.

IN the course of its survey of general industrial conditions, the *Monthly Record* of the Manchester Chamber of Commerce, discussing the position in the engineering industry, says that in the engineering world the events of the past month have included the placing of contracts for fifty locomotives for the Great Western Railway Company and sixty-six for the Indian State Railways. The order for the fifty is reported to have gone to a Glasgow firm, while thirty-nine of the sixty-six have been divided between Manchester and Newton-le-Willows firms, a Swiss concern getting twenty-seven. Some makers of machine tools report that they have received more inquiries and booked more orders, but others state that in their case the demand eased off a few weeks ago. Gear cutters generally have been well employed, this applying particularly, though not exclusively, to those who supply gears for the motor building trade. Some of the heavy electrical firms have been busy, and cable making has continued active. Textile machinists who specialise in machinery for the artificial silk trade have, as a rule, a good deal of work in hand, but other sections are not all well engaged, home trade orders being few and small, and foreign orders not being numerous enough to fill the gap.

Electricity Profits and Progress.

Some interesting information bearing on the extremely rapid growth of the Preston electricity undertaking which, under the Electricity Board's scheme for the North-Western area is to be the second largest producer of electricity, was given by the chairman of the Electricity Committee at a meeting of the Town Council. In 1921 the output of the undertaking was 3¼ million units, and it has gone up to 40 millions this year; by 1931 it is estimated that the production will be 200 million units, and by 1934 421 millions. Thus, from a position of comparative obscurity in the electrical world, Preston, in six years, has reached a very prominent place. In 1922 the average price obtained for current was 5¼d. per unit, and it has fallen gradually to 1·2d. The chairman described the undertaking as being "nicely profitable," in spite of the fact that they paid about £300,000 to buy out the old private company, the plant of which they proceeded immediately to scrap, and had spent about £1,500,000 on the new power station. The accounts of the electricity undertaking at Oldham show a profit for the past year of £29,500, which is the highest in the history of the undertaking. The department, which now has a reserve fund of £105,000, borrowed £396,000 in 1915, and it is stated that all of this, with the exception of £19,600, has now been repaid. The Burnley undertaking made a profit of £24,990 for the past financial year. This Lancashire town claims to supply the cheapest electricity in the country.

Training for the Rubber Trade.

An interesting proposal of the Manchester Education Committee is to provide a workshop for rubber manufacture at the new Technical School at Newton Heath, Manchester, at a cost of £3000. Manchester, of course, is an important centre of the rubber industry, and the Committee points out that there is a real demand by the industry for youths with special training. Briefly, the scheme, which was established last January, when the first selection of twenty boys entered upon a course of instruction, provides for a two years' full-time course of training for selected youths of fourteen years of age, supplemented by two further years' part-time training after they have entered the industry. The point is emphasised that the scheme represents a most practical type of co-operation between education and industry in that the boys know beforehand to which firms they will go on the completion of their two-year full-time course, and in that the employers or their representatives have the fullest opportunities of watching their own boys during school training and of co-operating with the school authorities.

A Tin-smelting Development.

The new tin smelter of the Penpoll Tin Smelting Company, Ltd., at Bootle, Liverpool, is approaching completion, and will be officially put into operation by Lord Derby on Friday of next week. The smelting plant consists of eight large furnaces, and will treat principally Empire ores. The smelter will have an initial output capacity of about 1000 tons a month, but the plant has been so arranged that its capacity can be doubled within a period of six months.

Textile Plant for Egypt.

An important order has been secured by John Hetherington and Sons, Ltd., textile machinery makers, of Manchester, for the supply of cotton spinning, weaving and other textile plant for a new mill to be erected at Mehalla el Kobra, in the Egyptian Delta.

Non-ferrous Metals.

In no section of the non-ferrous metals market has there been any striking developments during the past week. At one period a fair recovery in the price of tin from the low level discussed a week ago was registered, but it was short-lived, and the reaction which has set in since has brought values down still lower on balance, so that the £200 mark looms steadily nearer. Buying interest in the metal is by no means pronounced, although both consumers and speculative interests appear to be ready as occasion warrants to step in and take advantage of the relatively favourable prices now ruling. The demand for copper has also proceeded on moderate lines during the week, but the underlying position of the metal seems to be fairly strong, and prices at the time of writing in the case of standard brands are a shilling or two higher than they were a week ago, refined descriptions keeping firm at late rates. With regard to lead the price position in this section is steady, and current values are hovering in the neighbourhood of those that were ruling during the previous two weeks, demand being maintained on a quietly steady basis. After its slight fall last week offers of spelter are back on the price basis of a fortnight ago, and a moderate business in the metal is being done.

Iron.

If the talk of sellers of foundry iron on this market during the last day or two takes practical shape, those con-

sumers who are delaying buying in the hope, as one user expressed it this week, of "getting on at 5s. below to-day's rates," are doomed to disappointment. Current selling prices for foundry iron are probably on an uneconomic basis for a good many producers, but, having regard to the relatively large number of makers in the Midland counties, stabilisation of prices will prove to be a less easy matter than it has been, say, on the North-East Coast. The demand this week has been patchy, and the total tonnage booked has been considerably below the normal, even for the time of the year. Staffordshire and Derbyshire brands have been variously quoted between 68s. 6d. and 70s. per ton, delivered Manchester or equal, and although the position has not perceptibly weakened compared with a week ago, buyers have had little difficulty in finding sellers willing to accept the lower figure. Middlesbro' iron has been maintained at 79s.; Scottish at 87s. 6d.; and hematite at 82s. 6d to 83s., delivered Manchester. Bar iron is attracting its usual quiet volume of trade, with quotations unchanged at £10 per ton for Lancashire Crown bars and £9 10s. for second quality material.

Steel.

In the steel market a moderate business continues to be done in constructional materials, and a certain amount of buying is reported in the case of boiler plates. Prices are quite steady on the whole, with small re-rolled bars quoted at £7 12s. 6d. to £7 15s.; large bars at £8 17s. 6d.; sections at £7 17s. 6d.; boiler plates at £9 12s. 6d. to £9 17s. 6d.; and general plates at £8 12s. 6d. Orders for imported steel materials are usually for comparatively small quantities, and it is not unlikely that the easier feeling in this section of the market will have a restrictive influence on buying operations. Apart from wire rods, which are slightly firmer at from £6 15s. to £6 17s. 6d. per ton, for cash against shipping documents, and including delivery to works in the Lancashire area, the majority of lines are available on terms which, compared with recent rates, are more favourable to consumers, imported joists being quoted at £5 18s. per ton; steel bars at £6 14s.; Thomas plates at £7 6s. to £7 7s. 6d.; billets at £5 7s. 6d.; and sheet bars at £5 10s. to £5 12s.

BARROW-IN-FURNESS.

Hematite.

The condition of the hematite pig iron trade gives cause for concern. There is no feature about it which invites optimism. At the majority of the works the production exceeds the demand, and this state of things has gone on for some time. There are a few who say that towards the autumn there will be an improvement, but others doubt it. It was hoped that the consumption of iron would increase in Barrow, as it was reported that the rail departments would be starting this week, but such is not the case. The fact is that customers are taking only sufficient for immediate requirements, and the tonnage in practically every case is low. The Midlands continue to be the best customer, but there is much room for improvement. Small cargoes are going to the Continent every now and again. The ore trade is dull, as is to be expected, and local mines are not sending much out of the district. Foreign ores are being bought in restricted quantities. The steel trade is not bright. Workington has started again on rails and sleepers this week, probably on orders which have been accumulating during the period of idleness. Barrow, it was reported, would start the rail mills this week, but preparations were suspended, and it is not known now when they will get to work. The hoop mills are busy, and there have been despatches of hoop banding to Egypt and America.

Shipbuilding and Engineering.

In about a fortnight there will be launched from the yard of Vickers-Armstrong the Admiralty tender "Medway." No particulars are available as to her measurements, but she is said to be about 600ft. long. This vessel will be driven by twin sets of M.A.N. internal-combustion engines of which Vickers own the British rights. Another vessel of a similar type is at present on the stocks but it is not so far forward.

SHEFFIELD.

(From our own Correspondent.)

Condition of the Steel Trades.

WITH the exception of special departments, there is little of a satisfactory nature to be reported of the steel trades of this district. Mr. Bernard Firth, speaking at the annual meeting of John Brown and Co., Ltd., summed up the general position when he said that there were signs of improvement in the iron and steel branches during the earlier months of the year, but that recently trade had fallen off badly, and for the last month or two everybody seemed to be ordering nothing. At the moment, the position of the acid steel side is unsatisfactory, there having been a falling off in the demand lately. The higher prices of continental material, on the other hand, are proving of some benefit to the basic steel branch, which has a rather more hopeful outlook. Two of the three furnaces at Vickers-Armstrongs' works which were closed before Whitsuntide have been restarted. On the completion of stocktaking at Templeborough, eight out of fourteen furnaces resumed operations last week, but the extent to which the rest of the plant will restart will depend on the amount of work received during the next few days.

How Other Trades Affect Sheffield.

Sheffield, of course, depends for its prosperity upon a number of trades which are carried on in other parts of the country, and it happens that at present several of these trades are quiet, and are not making much demand on the city's productive capacity. The coal trade is buying hardly any steel materials, and the building of privately owned wagons has fallen almost to nothing. The closing of many cotton mills has had a serious reaction upon engineering and other steel-consuming works. The extreme quietude of the building trade also means loss to Sheffield. One of the city's best customers is the electrical engineering industry, and one of the bright spots in Sheffield itself is the activity of the works of the Metropolitan Vickers Company at Tinsley, where the firm makes its electric motors. These, as well as the Manchester works of the same company, have been working at their full capacity for a considerable period, and employing many thousands of hands, and they have enough contracts on hand to assure them of busy times for the rest of this year. The automobile industry continues to make large demands upon Sheffield, but there has been a tendency for its requirements to shrink since the beginning of the year, and the firms supplying them are not all equally well off for work. A special department which continues to expand is that engaged in the manufacture of stainless steels. To quote Mr. Bernard Firth again, the demand grows from day to day, and the firm of Thos. Firth and Sons, Ltd., is finding it necessary to enlarge the departments in which these steels are manufactured. The *Journal* of the Sheffield Chamber of Commerce reports that a test is being made with a big ship-plate, made of stainless steel, on a 13,000-mile voyage on a Blue Star liner.

The Lighter Trades.

Most of the lighter trades are sharing in the general shrinkage of business, with the result that competition and price-cutting have been increased. The saw trade is only moderately well employed. In garden tools, the season's trade has proved below the average, but at the same time larger than the bad weather had led people to anticipate. There is a good deal of patchiness in the cutlery and plate sections, and in some cases makers state that the demand from overseas has declined. The Chamber of Commerce *Journal* states that most of the firms in the light trades could do with 25 to 50 per cent. more work, and more profitable prices, but by cost economies, readiness to meet customers' desires, and improved methods of salesmanship, foreign competition is being fairly well met in most lines, and excellently well met in some. "Safety razor blades and blanks," continues the *Journal*, "continue to go out from Sheffield works in immense quantities. Their high quality is bringing forth striking and unsolicited testimonials from almost all quarters. Sheffield has lost much of its old trade in ordinary razors, but it has got a good grip on the trade in the new kind of face shavers. The export of nearly 750,000 dozens of blanks and blades to the United States alone in one month speaks volumes for Sheffield quality."

A Busy Works Leaving Sheffield.

The firm of Robert Hyde and Son, Ltd., iron and steel founders, of Abbeydale Foundry, Sheffield, and of Chesterfield, is so busy that it finds it necessary to take immediate steps to extend its works. It specialises in axle-boxes for the railways. At Sheffield, where it employs about a hundred men, it achieved a record output three times during the past month. The situation of the Abbeydale Foundry is such that extension is impossible, and the firm has therefore decided to remove the Sheffield part of its business to Stoke-on-Trent. It has purchased there a large section of the North Stafford Locomotive Works—three times the size of its present works—which were vacated by the North Staffordshire Company when the railway grouping scheme came into operation. It is understood that the firm will be able to treble its present output when the removal is completed. There is another large section of the locomotive works which it can take over if further extension should be found necessary. A number of the skilled men will be taken from Sheffield, and the unskilled labour will be recruited from the Stoke district. The transfer will commence in about a month's time, and will be carried out gradually.

Dustless Refuse Collection.

The Health Committee of Sheffield City Council has been considering the question of using a type of wagon for collecting household refuse which will be perfectly dustproof, and has decided to give a trial to a new system. It reports that the system which it is of opinion is the most efficient and least likely to develop mechanical faults, is that in which the vehicle used for collection consists of a container or body which is cylindrical in form, and has four circular loading doors with self-closing lids on one side, and a hinged cover at the rear for the discharge of refuse. The loading doors are fitted with automatic lids which open together with the lids of the bins, so that the rims of the bins and those of the circular doors meet and make a dustproof joint. The whole of the process is entirely dustless. The Committee has interviewed the owner of the patent rights of the special type of bin required for this scheme, and it recommends that the system be given a trial, at an estimated cost of £2000, to include the purchase of about 2000 of the patented bins and of one container.

High-pressure Boilers.

Lord Aberconway, chairman of John Brown and Co., remarked at the annual meeting of the company last week that during the past twelve months very interesting experimental work had been carried on in connection with high-pressure boilers. He said the firm was now very well equipped for dealing with high-pressure land and marine boilers. It employed forgings of unusual size and strength, and its presses were very well employed at the present moment. The prospects were such that it hoped to continue the present output of this class of work.

New Lincolnshire Bridges.

A great improvement which has been carried out at Grimsby, by the erection of a new bridge over a cutting between two arms of the Alexandra Dock, was brought into use last week for vehicular and commercial traffic, although its opening to the public generally will not take place until the 16th inst., when the ceremony will be performed by the Prince of Wales. The bridge has been built at a cost of approximately £55,000, and it connects the older parts of the town with the West Marsh area, which has its timber yards and saw mills and is fast developing, and which leads to the district of Little Coates, on which are established oil and fertiliser factories, paper mills and other industries. The bridge is of the rolling bascule type, and replaces an old one of the swing span variety, which has done duty since 1872. The designer was Mr. A. C. Gardner, docks engineer to the London and North-Eastern Railway Company, and the contractors Sir William Arrol and Co., Ltd., of Glasgow. The roadway of 33ft., provided by the new structure, is twice the width of that of the old one, and there are, in addition, two footpaths of nearly 8ft. each, built outside the main girders. The leaf of the bridge is operated by electricity, but it is so well balanced that, at any angle of its progress from the horizontal to the vertical, it can be worked by two men with a hand winch. Electrically operated gates guard the approaches to the bridge, and, as a result of interlocking of mechanism, the bridge cannot be opened unless the road gates are closed to traffic, nor, on the other hand, can the gates be opened until the bridge has been closed. Another Lincolnshire road improvement consists of the construction of a diversion road and bridge at Scunthorpe. The work has been carried out by the London and North-Eastern Railway Company in connection with extensive railway developments, and replaces a level crossing on the Brigg road. The roadway over the bridge is 30ft. wide, and has a 7ft. footpath on each side. The contractors were Messrs. Caffin and Co., of London.

NORTH OF ENGLAND.

(From our own Correspondent.)

Iron and Steel Trade Depression.

THE iron and steel industry of the North-East Coast is passing through a period of grave anxiety. Business continues to languish, production is falling, and the paralysing effect of dull and apathetic markets is most clearly evident in the neighbourhood of Teesside. Even of a considerably diminished volume of trade, Cleveland is not getting its full share. As a consequence, four blast-furnaces have been put out of action during the past month in the Cleveland area. There are seven fewer blast-furnaces operating on the North-East Coast than there were in January last, and the present number in blast—thirty-three—is the lowest figure recorded since the coal strike. The steel works are equally badly hit. Those that are working are operating far from capacity, and the lack of orders is so serious that Dorman, Long and Co., Ltd., have stopped their steel furnace plant at the Britannia Works for an indefinite period. The firm also proposes to damp down a blast-furnace at its Newport Works.

The Export Trade.

A tonnage of 5622 tons of pig iron shipped from the Cleveland district during June represents the smallest volume of exports for any month since the coal strike. Coastwise shipments, totalling 10,012 tons, were on a rather better scale, but the aggregate of 15,634 tons of pig iron shipped from the district in June marks the lowest tonnage of any month this year. On the other hand, manufactured iron and steel shipments, which amounted to 68,778 tons in June, have been on the highest level since October last. There has been a big jump in the trade with Japan, about 3000 tons more material was shipped to India, while 13,865 tons shipped to South and East African ports more than doubles the May figures.

Iron and Steel Imports.

There is a sustained reduction in the imports of pig iron and steel from foreign countries to the Tees. Statistics presented at this week's meeting of the Tees Conservancy Commission showed that from November, 1927, to June 30th last, 151,037 tons of material had been received, as compared with 278,063 tons for the corresponding period of 1926–27, and 47,944 tons in the pre-war years of 1913–14. An interesting feature of the figures is that during the past month only 500 tons of pig iron were imported, as against 6855 tons in 1927 and 37 tons in 1914. There was a slight increase in the imports of plates, bars, angles, rails, sheets, joists, &c., but imports of crude sheet bars, billets, blooms, &c., were several thousand tons down, compared with June of 1927.

Cleveland Iron Market.

The Cleveland pig iron market shows little movement. Business continues on a very disappointing scale and the prevailing opinion is that the worst has not yet been experienced. A few welcome inquiries are circulating, some of them being from quarters with which Cleveland firms are anxious to re-establish business relations, but actual transactions are not readily put through. Output is mainly going into direct consumption at local works. Ironmasters adhere to the fixed prices:—No. 1 Cleveland, 68s. 6d.; No. 3 G.M.B., 66s.; No. 4 foundry, 65s.; and No. 4 forge, 64s. 6d.

Hematite Pig Iron.

The output of East Coast hematite pig iron, though far from heavy, is excessive, and the steadily increasing stocks keep prices well below cost. Though a few home and overseas sales have tempted makers to take a little firmer stand, price cutting continues. Nominally, recognised market rates are based on mixed numbers at 69s., but consumers claim that they can purchase on lower terms.

Ironmaking Materials.

Consumers of foreign ore show no disposition to negotiate for supplies, though their stocks cannot now be heavy, and merchants prophesy an advance in prices. The strike of ore miners in Sweden must have virtually exhausted stocks in that country. A little ore is understood to be still held at Lulea. Believing that blast-furnace coke is likely to be fairly plentiful, ironmasters are not

purchasing at all extensively. Good average descriptions are 17s. 6d. to 17s. 9d. delivered at the works.

Manufactured Iron and Steel.

Much quieter conditions prevail in the manufactured iron and steel trade. Demand for semi-finished steel has fallen off, due to reported weakening tendency of continental markets. Eastern customers for finished steel are stated to be making purchases, but Indian and Japanese orders are reported to have been secured largely by continental firms. Shipbuilding specifications are not coming forward at all well and contracts for railway material, as well as for constructional steel, fall much below what could be desired. Quotations show no movement.

The Coal Trade.

There are still no signs of a revival in the Northern coal trade. New business is extremely meagre. Yorkshire competition, under the bounty scheme, is now telling more definitely against this district, and trade which usually comes to Northumberland has been lost. There has been a considerable amount of idle time at the pits recently, and in Durham one or two additional collieries have been closed down. The position in Northumberland is really very serious, and it is many years since some of the pits worked so badly. Foreign competition has given the Northumberland coal trade many hard knocks in recent years, but the under-cutting due to the five-counties plan to capture export business promises to be the hardest blow of all. The collieries, however, are not inclined to risk further losses by making another cut in prices. All descriptions of coal are freely offered. Steams are finding competition at home and abroad very keen. Best Northumberland qualities are still quoted at 13s. 6d., with seconds at 12s. Smalls are steadier in tone, although not quotably altered, but the tendency is upwards in view of the unsettled volume of production. Special kinds command from 11s. to 11s. 6d., bests 8s. to 9s., and good ordinary class 8s. The Durham position is also discouraging. There is a pronounced lack of prompt business, whilst fitters are anxious for early clearance. Best gas coal is put at 14s. 9d. to 15s., and second qualities at 13s. 3d. to 13s. 6d. Coking coal inquiries are circulating, though actual trade matures slowly. Trade in bunker coals is rather slow at the moment, and prices are barely steady. The strikes at the various continental centres are limiting the demand for coke for early shipment, with the result that supplies are offered more freely and at slight discount prices, but while spot buyers can cover advantageously, the delays in shipment tend against forward operators, who find prices hardening. Gas coke, while easy for prompt at 20s., is firm forward at 20s. 6d. to 21s. Patent oven cokes, good qualities, offer at 18s. prompt, but forward the tone is firm at 18s. 6d. to 19s. Beehive and special cokes hold at 23s. to 27s.

SCOTLAND.

(From our own Correspondent.)

New Shipbuilding Contracts.

THE Fairfield Shipbuilding and Engineering Company, Ltd., has received an order from the C.P.R. to build a liner of 25,000 tons gross. The vessel, which is intended for her owners' Pacific services, will be 662ft. in length, 83ft. 6in. in breadth, and 56ft. 9in. moulded depth, while her speed will be 21 knots. The propelling machinery will be similar to that installed in the "Duchess" vessels, built or being built at Dalmuir and Clydebank, and consisting of single-reduction geared turbines obtaining steam from high-pressure water-tube boilers. This order is the first of two for which tenders were recently invited, and it is confidently anticipated that the other will also be placed on the Clyde. Harland and Wolff, Govan, are to build a cargo steamer of 9000 tons for the Hain Steamship Company, Ltd., Cardiff. Apart from the foregoing, recent contracts have been extremely light, consisting entirely of small craft. The rate of fresh bookings is still too slow to justify a hopeful outlook for the winter months.

Markets Unchanged.

The steel, iron and coal trades hold nothing of fresh interest, and business is more or less confined within recent small and unsatisfactory limits.

Steel.

The position with regard to heavy steel is still one of depression. Few of the works concerned have any improvement to report, and specifications continue scarce. The demand for light material is better than in the heavy department, although it is not on a satisfactory basis.

Steel Sheets.

It cannot be said that either black or galvanised sheets are well booked, more especially as regards the cheaper varieties. Some good foreign orders have come to hand, however, for specially finished light sheets. Black sheets, 10 gauge, are quoted about £8 10s. to £8 15s. per ton. Galvanised corrugated sheets have firmed by 2s. 6d. per ton, the current quotation being round about £13 7s. 6d. to £13 12s. 6d. home and £13 7s. 6d. per ton export.

Iron.

Bar iron continues dull, and export might be done below the nominal quotation of £9 15s. per ton. Orders for re-rolled steel are insufficient to maintain regular employment, and with prices "free" quotations are easy. Prices are nominally £7 7s. 6d. home and £7 per ton export.

Steel Plates and Sections.

Consumers of plates and sections are purchasing on a hand-to-mouth basis. Employment at the section mills has been helped to some extent by orders for steel rails. Otherwise the plants would have been very idle.

Pig Iron.

Both the demand and the prices obtained for pig iron are unsatisfactory, and in all probability the production will be further reduced in the near future. At present only about twenty-seven furnaces are in blast. Prices are nominally unchanged.

Exports and Imports.

During the past week 16,500 tons of iron ore, 3000 tons of pyrites and 2000 tons of iron and steel products were discharged at Glasgow docks. Exports included 3500 tons of iron and steel products and 1503 tons of pig iron.

Labour Affairs.

The Executive of the National Union of Scottish Mine Workers has decided to oppose the re-election of Mr. A. J. Cook as the Miners' Federation representative to the General Council of the Trades Union Congress, and will nominate Mr. James C. Welsh as substitute. Employers in the Light Castings Association are asking for a reduction of 10s. per week in the bonus paid to piece-workers, and 10 per cent. on time wages, also a reduction of 2s. 6d. per week in the rates paid to labourers. The men desire a maintenance of wages all over the country, and the conference has been postponed until July 19th to allow the men's representatives again to consult their different unions.

Coal.

With the exception of best Lanarkshire splints and, in a lesser degree, Fifeshire steams, there is no lack of supplies of round coal, in spite of the drastic reduction in output which has been accomplished under the collieries' scheme to stabilise the industry. On the other hand, washed nuts are difficult to obtain, especially the smaller sizes. Aggregate shipments amounted to 220,832 tons, against 218,302 tons in the preceding week and 241,597 tons in the same week last year.

WALES AND ADJOINING COUNTIES.

(From our own Correspondent.)

Coal Trade Conditions.

THE position so far as the coal industry is concerned leaves much to be desired and indeed continues to cause considerable anxiety to coalowners, coal-exporters, and every branch of workman employed. An increasing number of undertakings experience great difficulty in carrying on, and during the past week or so notices have been served upon an additional number of workmen terminating their contracts. Although no official report was issued of the interview which representatives of the Mining Association had with the Chancellor of the Exchequer on Thursday of last week for the purpose of impressing upon him the necessity of expediting relief from rates under the Budget proposals of the Government, which are to become operative in October next year, it is understood that sympathetic as the Cabinet is to the request put forward, there is little or no hope of the relief scheme operating earlier than has been arranged. This is a very serious matter, as it is practically certain that many colliery undertakings under the existing conditions of trade cannot keep going for another twelve months. The foreign demand for coals is altogether inadequate to create the semblance of activity in the industry, apart from which the prices of coal obtainable are quite unremunerative. Shipments last week were 464,299 tons, as against 562,035 tons in the previous week. It is doubtful whether they will be any better this week. The tonnage position is very unsatisfactory. On Saturday last returns showed that there were no less than 54 idle tipping appliances at the various docks in this district. Week-end arrivals brought the number of idle tips down to 32 on Monday, and on Tuesday there was a further slight improvement, inasmuch as, although there were still 32 vacant berths, there were eight steamers waiting.

Effect on Docks.

Evidence of the depression in trade is found in the action of the railway companies in giving notice that as from Monday next the loading of coal or the loading or unloading of other traffic will not be undertaken at the South Dock, Swansea, and at the Town Dock, Newport. It is considered that the facilities for dealing with the trade available are adequate at the other docks, and consequently notices have been served upon the tippers at the two docks mentioned, bringing to an end their engagements. It is understood that about thirty-six tippers are affected, though it is possible that other work may be found for some of the men. Vessels will not be prevented from entering and leaving the two docks in question, but they will have to load or discharge with their own gear.

Coalfield Items.

It is reported that the whole of the officials employed by North's Navigation Collieries, Ltd., in the Maesteg District, have received notices, the collieries concerned including Caerau, Cwmdu, Maesteg Deep and Garth. The men working at these collieries are at the present time working on day to day contracts, and number about 7000. Messrs. Vipond's Varteg Colliery closed down on Saturday last, about 1000 men being affected. The workmen met on Monday to consider the question of a concession of 10 per cent. of their wages with a view to enabling the colliery to continue working, but the men only confirmed their previous decision not to agree to the cut.

Current Business.

The inquiry for steam coals has been very quiet, but nominally prices have undergone no alteration. The proposal that the stabilisation scheme as originally drawn up, which involved a binding agreement upon collieries to charge not less than the prices fixed for the various grades of coal and under which collieries working should contribute 3d. per ton to a pool for the benefit of those undertakings which lost shifts, should come into operation as from the 2nd inst. did not mature. The inference is that the response from the collieries was not sufficient to justify the Executive Committee of the South Wales Coal Marketing Association proceeding with the scheme, though it must not be assumed that it has been dropped. For the time being, at any rate, the present arrangements will be continued under which the group committees will meet from time to time and make representations regarding prices which will be voluntarily adhered to by the various collieries. So far as contract business is concerned, it is understood that the Buenos Aires Great Southern Railway has contracted for 90,000 tons of Monmouthshire coals to be delivered from July to November, but news is awaited in respect of the placing of the contract for supplies to the M. Z. A. Railway of Spain. The current demand for coals is still comparatively dull, though exporters certainly hold more orders this week than was the case last week. The bulk of these orders are for the Mediterranean destinations, but more business is needed. The patent fuel and coke markets remain quiet, but pitwood is steadier owing to reduced supplies of this commodity coming along.

LAUNCHES AND TRIAL TRIPS.

BENEDICK, motor vessel; built by Blythswood Shipbuilding Company, Ltd., to the order of the Bear Creek Oil and Shipping Company, Ltd.; dimensions, length, 450ft.; breadth, 58ft.; depth, 32ft. 9in.; to carry 10,250 tons. Engines, single-acting Diesel; constructed by J. G. Kincaid and Co., Ltd.

WANDA, twin-screw steamer; built by Palmer's Shipbuilding and Iron Company, Ltd., to the order of Polish State Steamship Company; trial trip, June 18th.

HIGHLAND CHIEFTAIN, twin-screw passenger and refrigerating cargo motor ship; built by Harland and Wolff, Ltd., to the order of H. and W. Nelson, Ltd.; dimensions, length, 520ft.; breadth, 69ft.; depth, 35ft. 9in.; to carry 14,450 tons. Engines, two eight-cylinder double-acting four-cycle; launch, June 21st.

ADELA, twin-screw oil tank steamer; built by Sir W. G. Armstrong, Whitworth and Co., Ltd., to the order of the Anglo-Saxon Petroleum Company, Ltd.; dimensions, length, 305ft.; breadth, 50ft.; 2300 tons deadweight. Engines, inverted direct-acting triple-expansion surface condensing, pressure 180 lb. per square inch; trial trip, June 22nd.

FINNANGER, twin-screw motor tank vessel; built by Netherland Shipbuilding Company; dimensions, length, 493ft. 6in.; breadth, 64ft. 3in.; depth, 36ft. 6in.; 13,582 tons. Engines, two four-cycle single-acting Werkspoor Diesel, bore 26¾in. by 47¼in. stroke; launch, June 23rd.

SALFORD CITY, sewage sludge steamer; built by Wm. Beardmore and Co., Ltd.; dimensions, length, 240ft.; breadth, 38ft.; depth, 16ft.; to carry 1000 tons of sludge. Engines, two sets of inverted triple-expansion surface condensing, pressure 180 lb. per square inch; launch, June 28th.

ST. THERESE, single-screw cargo ship; built by Swan, Hunter and Wigham Richardson, Ltd., to the order of Jens Lund and Co.; dimensions, length, 292ft.; breadth, 44ft.; depth, 21ft. 6in.; 3750 tons deadweight.

DESIGNER, steel screw cargo steamer; built by David and William Henderson and Co., Ltd., to the order of the Charente Steamship Company, Ltd.; dimensions, length, 420ft.; breadth, 54ft. 6in.; depth, 32ft. 6in.; grass tonnage, 5800. Engines, triple-expansion, 27in., 46in., and 77in. diameter by 54in. stroke, pressure 210 lb. per square inch; launch, July 3rd.

THE "CHARLES R. E. BELL FUND" SENIOR TRAVELLING SCHOLARSHIPS.—Two "Charles R. E. Bell Fund" Senior Travelling Scholarships of £150 each, which were instituted for the purpose of encouraging the study of modern foreign languages by enabling the holders to live abroad for a period of not less than six months, have been awarded for 1928 by the Commercial Education Committee of the London Chamber of Commerce. One scholarship was gained by Mr. George R. Wensley, of the University College of South Wales and Mon., and a second scholarship was gained by Mr. Bernard A. R. Carter, of Coventry.

STRUCTURAL ENGINEERS' SCHOLARSHIP.—The annual Travelling Scholarship, value £300—this year named the "Dorman-Long" Scholarship—has been awarded by the jury of the Institution of Structural Engineers to Mr. George Caddell, of New Ferry, Cheshire, who also receives the gold medal which the Institution couples with the money award. The competition for the scholarship is one in design, and this year the candidates were required to re-design the Royal Exchange as a modern steel-frame building. The City authorities gave the Institution permission to reproduce, for the information of the candidates, the old original plans and drawings of the Royal Exchange. Candidates had to make an original plan and sketch under supervision, twelve hours being allowed. A tracing was deposited with the supervisor, and the candidates then had twenty-eight days in which to make complete designs, which had to adhere to the original sketch as a basis, thus tying them down to what had in the first place been their own original work. The winner is required to utilise the award for foreign travel and study.

THE BRITISH ELECTRICAL AND ALLIED MANUFACTURERS' ASSOCIATION.—Last Tuesday evening a dinner was given by the British Electrical and Allied Manufacturers at the Connaught Rooms, when Colonel R. C. Morcom, chairman of the Council of the Association, presided. Mr. L. S. Amery, M.P., Secretary for the Dominions and the Colonies, attended. Sir Arthur Duckham and Sir Hugo Hirst, who are members of the trade mission which is shortly going to Australia to study the possibilities of trade development between the two countries, were the principal guests. The toast of "Imperial Development" was proposed by Mr. Amery, who said that the great problem before us was that of converting our unlimited potential resources into realised wealth. Despite our immense resources, the growth of industrial equipment, the ability of our leading business men, and our capacity for production, we lacked an assured market in which that development could confidently expand. Sir Granville Ryrie, High Commissioner for Australia, supported the toast. Sir Arthur Duckham responding, said that one of the main factors in inter-Empire relations was the distance separating the Mother Country from those great lands of promise overseas, which composed the Empire. The Association was doing more than any other body to annihilate space, and thus to make intercourse easy between the integral parts of this great Empire. Sir Hugo Hirst also replied. The toast of "The Chairman and Council" was submitted by Mr. Herbert G. Williams, Parliamentary Secretary to the Board of Trade, the chairman acknowledging it.

Current Prices for Metals and Fuels.

IRON ORE.

N.W. COAST—	
(1) Native	19/- to 21/-
(1) Spanish	19/- to 21/-
(1) N. African	19/- to 21/-
N.E. COAST—	
Native	18/- to 21/-
Foreign (c.i.f.)	22/6

PIG IRON.

	Home. £ s. d.	Export. £ s. d.
(2) SCOTLAND—		
Hematite	3 14 0	—
No. 1 Foundry	3 15 0 to 3 16 0	—
No. 3 Foundry	3 11 0	—
N.E. COAST—		
Hematite Mixed Nos.	3 9 0	3 9 0
No. 1	3 9 6	3 9 6
Cleveland—		
No. 1	3 8 6	3 8 6
Silicious Iron	3 8 6	3 8 6
No. 3 G.M.B.	3 6 0	3 6 0
No. 4 Foundry	3 5 0	3 5 0
No. 4 Forge	3 4 6	3 4 6
Mottled	3 4 0	3 4 0
White	3 4 0	3 4 0
MIDLANDS—		
(3) Staffs.—		
All-mine (Cold Blast)	—	—
North Staffs. Forge	—	—
,, ,, Foundry	3 2 6	—
(3) Northampton—		
Foundry No. 3	2 16 6 to 2 17 0	—
Forge	2 13 6	—
(3) Derbyshire—		
No. 3 Foundry	3 1 0 to 3 2 0	—
Forge	2 19 0	—
(3) Lincolnshire—		
No. 3 Foundry	3 1 0	—
No. 4 Forge	2 18 6	—
Basic	3 0 0	—
(4) N.W. COAST—		
N. Lancs. and Cum.—		
Hematite Mixed Nos.	4 1 0 (a) / 4 4 0 (b) / 4 7 6 (c)	—

MANUFACTURED IRON.

	Home. £ s. d.	Export. £ s. d.
SCOTLAND—		
Crown Bars	10 5 0	9 15 0
Best	—	—
N.E. COAST—		
Iron Rivets	11 5 0	—
Common Bars	10 5 0	—
Best Bars	10 15 0	—
LANCS.—		
Crown Bars	10 0 0	—
Second Quality Bars	9 10 0	—
Hoops	13 0 0	—
S. YORKS.—		
Crown Bars	10 10 0	—
Best Bars	11 0 0	—
Hoops	11 10 0 to 12 0 0	—
MIDLANDS—		
Crown Bars	9 5 0 to 10 0 0	—
Marked Bars (Staffs.)	12 0 0	—
Nut and Bolt Bars	8 17 6 to 9 0 0	—
Gas Tube Strip	11 0 0	—

STEEL. (d)

	(6) Home. £ s. d.	(7) Export. £ s. d.
(5) SCOTLAND—		
Boiler Plates	10 10 0	10 10 0
Ship Plates, ½in. and up	8 7 6	7 12 6
Sections	7 17 6	7 2 6
Steel Sheets, ¼in.	8 12 6	8 10 0
Sheets (Gal.Cor. 24 B.G.)	13 7 6 to 13 12 6	13 7 6

STEEL (*continued*).

	Home. £ s. d.	Export. £ s. d.
N.E. COAST—		
Ship Plates	8 7 6	—
Angles	7 17 6	—
Boiler Plates	12 15 0	—
Joists	7 17 6	—
Heavy Rails	8 10 0	—
Fish-plates	12 0 0	—
Channels	10 5 0	£9 to £9 5
Hard Billets	7 12 6	—
Soft Billets	6 15 0	—
N.W. COAST—		
BARROW—		
Heavy Rails	8 5 0	—
Light Rails	8 10 0 to 8 15 0	—
Billets	7 10 0 to 10 0 0	—
MANCHESTER—		
Bars (Round)	8 17 6	—
,, (Small Round)	7 15 0	—
Hoops (Baling)	10 0 0	9 15 0
,, (Soft Steel)	9 0 0	8 15 0
Plates	8 12 6	—
,, (Lancs. Boiler)	9 12 6 to 9 17 6	—
SHEFFIELD—		
Siemens Acid Billets	10 0 0	—
Hard Basic	7 2 6 to 7 12 6	—
Intermediate Basic	7 0 0	—
Soft Basic	6 5 0 to 6 7 6	—
Hoops	9 10 0 to 10 0 0	—
Soft Wire Rods	7 10 0	—
MIDLANDS—		
Small Rolled Bars	7 10 0 to 8 0 0	—
Billets and Sheet Bars	5 17 6 to 6 0 0	—
Sheets (20 W.G.)	11 10 0 to 12 0 0	—
Galv. Sheets, f.o.b. L'pool	13 7 6 to 13 10 0	—
Angles	7 17 6	—
Joists	7 17 6	—
Tees	8 17 6	—
Bridge and Tank Plates	8 12 6	—
Boiler Plates	11 0 0	—

NON-FERROUS METALS.

SWANSEA—	
Tin-plates, I.C., 20 by 14	18/4½ to 18/7½
Block Tin (cash)	205 15 0
,, (three months)	203 10 0
Copper (cash)	63 0 0
,, (three months)	63 2 6
Spanish Lead (cash)	20 18 9
,, (three months)	20 15 0
Spelter (cash)	25 6 3
,, (three months)	25 3 9
MANCHESTER—	
Copper, Best Selected Ingots	67 15 0
,, Electrolytic	69 5 0
,, Strong Sheets	94 0 0
,, Tubes (Basis Price), lb.	0 1 1½
Brass Tubes (Basis Price), lb.	0 1 0
,, Condenser, lb.	0 1 2
Lead, English	22 5 0
,, Foreign	20 15 0
Spelter	25 10 0
Aluminium (per ton)	£107

FERRO ALLOYS.

	Per Ton.	Per Unit.
Tungsten Metal Powder	1/7½ per lb.	
Ferro Tungsten	1/3 per lb.	
Ferro Chrome, 4 p.c. to 6 p.c. carbon	£22 0 0	7/6
,, ,, 6 p.c. to 8 p.c. ,,	£21 15 0	7/-
,, ,, 8 p.c. to 10 p.c. ,,	£21 0 0	6/-
,, ,, Specially refined		
,, ,, Max. 2 p.c. carbon	£33 18 0	12/-
,, ,, ,, 1 p.c. carbon	£39 0 0	15/-
,, ,, ,, 0·70 p.c. carbon	£45 0 0	17/-
,, ,, ,, carbon free	1/2 per lb.	
Metallic Chromium	2/8 per lb.	
Ferro Manganese (per ton)	£13 10 0 for home £13 10 0 for export	
,, Silicon, 45 p.c. to 50 p.c.	£12 15 0 scale 5/- per unit	
,, ,, 75 p.c.	£20 0 0 scale 6/- per unit	
,, Vanadium	14/3 per lb.	
,, Molybdenum	4/6 per lb.	
,, Titanium (carbon free)	1/2 per lb.	
Nickel (per ton)	£170 to £175	
Ferro-Cobalt	9/- per lb.	

FUELS.

SCOTLAND.

(Prices not stable.)

	Export.
LANARKSHIRE—	
(f.o.b. Glasgow)—Steam	13/9
,, ,, Ell	14/3 to 14/6
,, ,, Splint	16/- to 17/-
,, ,, Trebles	13/-
,, ,, Doubles	12/6 to 12/9
,, ,, Singles	12/-
AYRSHIRE—	
(f.o.b. Porta)—Steam	13/6
,, ,, Jewel	15/6
,, ,, Trebles	13/-
FIFESHIRE—	
(f.o.b. Methil or Burntisland)—Steam	10/9 to 12/9
Screened Navigation	18/-
Trebles	12/9 to 13/-
Doubles	12/6 to 12/9
Singles	11/6
LOTHIANS—	
(f.o.b. Leith)—Best Steam	12/-
Secondary Steam	11/6
Trebles	12/6 to 13/-
Doubles	12/6
Singles	11/6 to 12/-

ENGLAND.

(8) N.W. COAST—	
Steams	24/- to 25/-
Household	37/6 to 50/-
Coke	22/6 to 23/6
NORTHUMBERLAND—	
Best Steams	13/3 to 13/6
Second Steams	11/9 to 12/-
Steam Smalls	9/- to 9/6
Unscreened	11/9 to 12/-
Household	21/- to 27/-
DURHAM—	
Best Gas	15/-
Second	13/3 to 13/9
Household	21/- to 27/-
Foundry Coke	18/3 to 19/-

SHEFFIELD—	Inland.	Export.
Best Hand-picked Branch	26/- to 27/6	—
Derbyshire Best Bright House	19/6 to 20/6	—
Best House Coal	18/6 to 20/-	—
Screened House Coal	16/- to 17/-	—
,, ,, Nuts	14/- to 15/6	—
Yorkshire Hards	14/- to 16/-	—
Derbyshire Hards	14/- to 16/-	—
Rough Slacks	8/6 to 9/6	—
Nutty Slacks	5/- to 6/-	—
Smalls	3/- to 4/6	—
Blast-furnace Coke (Inland)	13/- at ovens	—
Furnace and Foundry Coke (Export), f.o.b.		18/6 to 19/6

(9) SOUTH WALES.

CARDIFF—	
Steam Coals :	
Best Smokeless Large	19/3 to 19/6
Second Smokeless Large	18/- to 19/-
Best Dry Large	18/- to 18/9
Ordinary Dry Large	17/3 to 18/-
Best Black Vein Large	17/6 to 17/9
Western Valley Large	17/- to 17/3
Best Eastern Valley Large	16/6 to 17/3
Ordinary Eastern Valley Large	16/3 to 16/6
Best Steam Smalls	12/6 to 13/-
Ordinary Smalls	11/- to 12/6
Washed Nuts	17/- to 19/6
No. 3 Rhondda Large	19/6 to 20/-
,, ,, Smalls	14/- to 14/6
No. 2 ,, Large	16/- to 16/6
,, ,, Through	14/6 to 15/6
,, ,, Smalls	12/6 to 13/6
Foundry Coke (export)	30/- to 37/6
Furnace Coke (export)	27/6 to 30/-
Patent Fuel	21/- to 22/-
Pitwood (ex ship)	27/3 to 27/9
SWANSEA—	
Anthracite Coals :	
Best Big Vein Large	33/- to 35/6
Seconds	24/6 to 27/6
Red Vein	20/6 to 27/-
Machine-made Cobbles	40/- to 43/-
Nuts	35/- to 43/-
Beans	23/6 to 26/-
Pease	18/- to 19/-
Breaker Duff	8/- to 8/3
Rubbly Culm	12/- to 12/6
Steam Coals :	
Large	17/6 to 18/6
Seconds	16/- to 17/-
Smalls	10/- to 12/6
Cargo Through	15/- to 16/-

(1) Delivered. (2) Net Makers' Works. (3) f.o.t. Makers' Works, approximate. (4) Delivered Sheffield. (5) Glasgow, Lanarkshire and Ayrshire.

(6) Home Prices—All delivered Glasgow Station. Boiler Plates 10/- extra delivered England. (7) Export Prices—f.o.b. Glasgow. (8) Except where otherwise indicated, coals are per ton at pit for inland and f.o.b. for export, and coke is per ton on rail at ovens and f.o.b. for export. (9) Per ton f.o.b. (a) Delivered Glasgow. (b) Delivered Sheffield. (c) Delivered Birmingham. (d) Rebate 12/6 joists and 10/- all other materials if home consumers confine purchases solely to British products.

French Engineering Notes.

(From our own Correspondent in Paris.)

The Steel Union.

In view of the smaller export demand during the past month or two the International Steel Union decided, at the Dusseldorf meeting, to make no change in the steel production for the third quarter of the year, which is to remain on the basis of an annual output of 29,287,000 tons for the four countries concerned. Another reason for not making a change is to be found in the situation created by the reported organisation in Great Britain and the United States for securing foreign trade, whereby continental products will not only be excluded as far as possible from those countries, but will meet with severe competition in neutral markets. The American menace, especially, is causing uneasiness, and there are suggestions that the only way to counter the attack is to create a distributing organisation on similar lines. So far as France is concerned, the home demand is likely to develop in view of the important works which it is proposed to put in hand, the most urgent being the Loucheur scheme for the construction of houses providing 260,000 flats. The work will be carried out within a period of five years. It will necessarily entail the consumption of a considerable quantity of steel and other metallurgical products.

Colliery Catastrophe.

The collieries in France are not usually liable to accidents from explosions of fire damp or from similar causes, and since the Courrières catastrophe about twenty years ago there has been no accident involving considerable loss of life; but on Saturday last an accident of an unusual character took place at the Roche-la-Molière Colliery, near St. Etienne, when fifty-three miners lost their lives. There was first a fire in a heap of coal dust underground. It was soon extinguished, but it was immediately followed by the caving in of the roof of a gallery, owing, it is believed, to the heat, and that broke the compressed air pipes, with the result that the compressed air drove the poisonous gases along the galleries, where more than 500 men were at work. Many of those who were got to the surface were in a dangerous condition.

The Trans-Saharan Railway.

As the Senate has not yet approved of the Bill for the creation of an Office des Etudes which is to settle definitely whether the proposal to construct a railway across the Sahara Desert is feasible or not, many of the Chambers of Commerce and all the colonial bodies are insisting upon immediate action being taken. The original scheme of a railway from the Mediterranean to the Niger has now developed into the more ambitious one of Algiers to the Cape, whereby the French line will connect up with the Belgian Congo railway, which will be extended to join the Cape to Cairo line. It is feared that, if the scheme is delayed unduly, there will be a risk of Italy forestalling the French by building a railway from Tripoli to the Niger, for which purpose, it is averred, Italy is endeavouring to extend the Tripolitaine frontier so as to reach the north side of Lake Chad. It is certain that the Sahara railway causes some misgiving amongst engineers, who see that the difficulties can only be overcome by completely modifying railway practice, notably by the use of locomotives with internal combustion engines. On the other hand, the Italians claim that a railway from Tripoli would pass through more suitable country, and, in France, the Sahara scheme is opposed by those who argue that the railway should pass through the maritime colonies of Senegal, Guinea, Ivory Coast and Dahomey. The drawbacks are that such a railway would be longer and would serve colonies already provided with traffic facilities, and it is also objected to for strategical reasons. Military and economical requirements both favour the Sahara railway, which would pass through the exceedingly rich territories of the French Sudan and the Upper Volta. The maritime colonies would be connected up with the railway by transversal lines. The trouble lies in crossing the desert, and if French engineers succeed in carrying out this work successfully they will have placed to their credit one of the greatest of railway achievements.

Industrial Heating.

The second international congress on industrial heating, which has just been held at the Conservatoire des Arts et Métiers, was interesting as showing that quite remarkable progress has been accomplished in the working out of this problem during the past year. Most of the papers dealt with processes of distillation and the economies effected in fuel consumption. Last year, for example, the production of benzol in France was 61,000 tons, and it will shortly be raised to 100,000 tons. This is a small amount and there is not much hope of its being considerably increased, despite the recognised advantages of benzol, which allows of higher compressions and does away with the trouble of detonation. The performances of the British machines in the Schneider Cup showed the advantages of a benzol mixture, and the use of benzol in the "Bremen" in its flight across the Atlantic gave it an appreciably longer range of action than would have been possible with petrol. Other matters dealt with were the suppression of smoke in towns by the general employment of semi-coke and synthetic anthracite, which is at present being produced at one of the collieries in the Pas de Calais; the growing use of small coals and of pulverised coal for steam raising, whereby the trade in agglomerate fuels has declined considerably, to the extent that some other outlet must be found for the tar residues, which are used as a binding material. It is believed that a sufficient opening for them will be found in the tarring of roads. The whole question of fuel production is undergoing continual changes, particularly in the direction of utilising the poorer qualities of coal which constitute the larger part of the French output. The number of modern gas-heated coke ovens is being steadily increased, and the French are aiming more at the production of methyl alcohol from the gases, than the extraction of liquid fuels from bituminous coal, the quality of which is not, as a general rule, sufficiently good to allow of the economical production of benzol and other liquid fuels. The French seek to make the best use of the poorer fuels, and the problem is not quite the same as in some other countries.

British Patent Specifications.

When an invention is communicated from abroad the name and address of the communicator are printed in italics.

When an abridgment is not illustrated the Specification is without drawings.

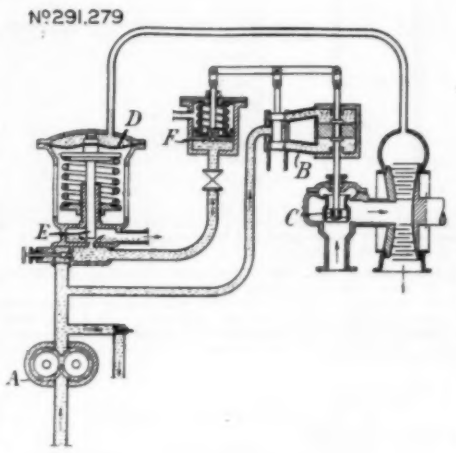
Copies of Specifications may be obtained at the Patent Office Sale Branch, 25, Southampton-buildings, Chancery-lane, W.C., at 1s. each.

The date first given is the date of application; the second date, at the end of the abridgment, is the date of the acceptance of the complete Specification.

TURBINE MACHINERY.

291,279. October 24th, 1927.—GOVERNING GEAR, *H. G. C. Fairweather*, 65, *Chancery-lane, London, W.C. 2.*

This invention has for its object the control of a steam turbine according to the exhaust pressure, so that the machine may, it is suggested, constantly operate under the best conditions. A pump A supplies an approximately constant pressure of oil to the relay B, which operates the main steam admission valve C. The diaphragm D is in communication with the exhaust space

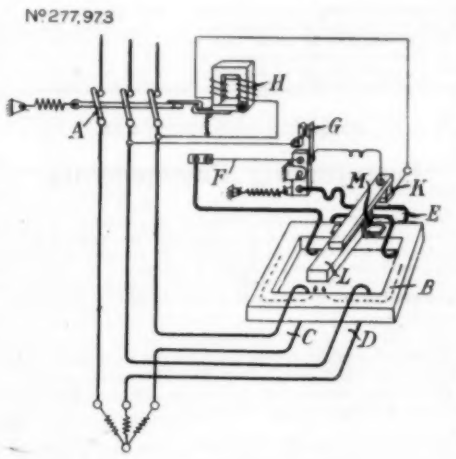


of the turbine, and controls the leak-away valve E, which is in the supply pipe of the relay piston F. It will be observed that if the exhaust pressure falls the spring in connection with the diaphragm D will open the leak-away valve E, and that the pressure under the piston F will be reduced. The relay valve will consequently be opened, oil under pressure will be admitted beneath the piston of the relay B, and the main steam valve will be opened.—*May 31st*, 1928.

SWITCHGEAR.

277,973. September 21st, 1927.—IMPROVEMENTS IN OR RELATING TO ELECTRIC OVERLOAD TRIPPING DEVICES, *International General Electric Company, Incorporated, of* 120, *Broadway, New York, U.S.A.*

The employment of current transformers for feeding thermally-operated releasing devices of excess current circuit breakers is known. According to this invention, only one current transformer is employed for protecting all the poles of a three-phase circuit breaker. The three poles of the excess current circuit-breaker A are controlled by the current transformer B. The

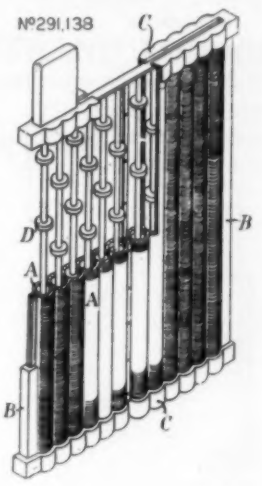


transformer has two primary windings C and D, which are connected up with the phases of the network in the manner shown and are wound in the same direction on the one shank of the transformer. The secondary winding E supplying the heating wire F is wound on the opposite shank. The contact G, actuated by the hot wire, is in the circuit of a no-voltage coil H which releases the circuit-breaker A when the contact G, or the contact K in series with it, is opened. The contact K is controlled by the current transformer armature L, which is pivoted at the point M.—*May 31st*, 1928.

BATTERIES AND ACCUMULATORS.

291,138. February 22nd, 1927.—IMPROVEMENTS IN AND RELATING TO THE ELECTRODES OF SECONDARY BATTERIES, "Hart" Accumulator Company, Ltd., and Wilfrid Schofield, both of 35, Marshgate-lane, Stratford, E. 15.

One of the causes of deterioration of lead batteries is the dislodgement of active material from the electrodes, more particularly the positive electrode. The invention relates to an electrode of the type in which access of the electrolyte to the active material is gained through slits. The two insulating sheets A, composing the plate, are in the form of troughs, in which the slits can readily be formed by cuts carried right across the plate. The two parts of the plate are held together by channel strips B, composed of ebonite. Top and bottom bars C are also employed. Washers D are provided on the usual central rods. These washers

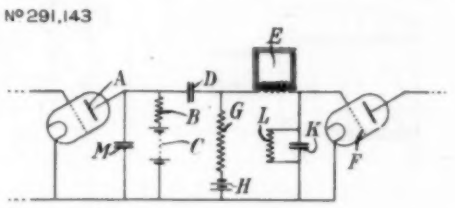


may be composed of insulating material or metal, and in the latter case they may be integral with the rods. The two parts of the plate A are filled with active material and then assembled in the manner shown.—*May 22nd*, 1928.

TELEGRAPHS AND TELEPHONES.

291,143. February 23rd, 1927.—IMPROVEMENTS IN OR RELATING TO THERMIONIC AMPLIFIERS AND CIRCUIT ARRANGEMENTS THEREFOR, Henry Joseph Round, of Westfield, Muswell Hill, London, N.

In resistance-coupled amplifiers, particularly those used in broadcasting receivers, the use of high magnification valves and anode resistances of high value results in a strong tendency for the amplification to fall off over the higher frequencies, particularly those above 2000 cycles per second, owing very largely to the capacities of the valves themselves. Moreover, when a by-pass condenser is employed in shunt with an anode resistance,



this condenser also tends to reduce amplification over the higher frequencies. The principal object of the present invention is to eliminate or minimise this trouble. Referring to the diagram the anode A is connected through an anode resistance B and battery C to the cathode. The anode is also connected through a coupling condenser D and an iron-cored choke E to the grid F of a second thermionic valve. The junction point of the condenser D and the choke E is connected through a grid leak resistance G and bias battery H to the common cathode connection which is also connected, through a condenser K which is shunted by a damping resistance L, to the grid F. M is a condenser shunting the resistance B and battery C.—*May 23rd*, 1928.

TRANSMISSION OF POWER.

284,341. January 27th, 1928.—ELECTRIC CABLE, S. A. des Câbleries and Tréfileries, of Cossonay, Canton of Vaud, Switzerland.

The electric cable described in this specification is characterised by the fact that it comprises at least four insulated wires, the whole constituting two electric circuits. The wires of these circuits are set alternately crosswise and form a square in cross-section. The wires of one of the circuits run between the wires of the other circuit, and inversely, in such a manner that the average spacing between the two wires of each circuit is a maximum, which has the effect of reducing their reciprocal capacity.—*May 31st*, 1928.

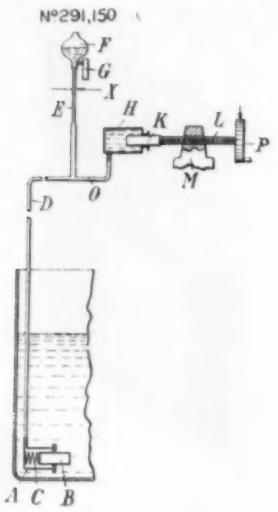
MEASURING AND TESTING INSTRUMENTS.

291,150. February 24th, 1927.—DISTANT-READING LEVEL GAUGES, B. Hocken, Mahaba, Polruan, Fowey, Cornwall.

In this gauge the tank has at, or near, the bottom, a cylinder A in which works a plunger B held in by the tension of a spring C. A pipe D is connected to the cylinder and to a transparent gauge tube E of fine bore which passes to an open receptacle F, shown as a flask, through a cock G. Below the transparent tube E a pipe O connects with a compensating or measuring cylinder H provided with a plunger K, which is operated by a screw L from a micrometer wheel P, the screw passing through a nut in a fixed abutment M. The cylinder A, pipes D and O and cylinder H are full of water or other suitable liquid, and an index X is provided on the gauge tube. The plunger B will be moved by amounts proportional to the height of water in the tank. When the level of liquid in the tank is at a given datum, the measuring plunger K is moved until the liquid in the tube E is at the datum and the reading is noted. If now the water rises in the tank, the piston B will be moved inwards and the liquid in the pipe system will move up into the flask F; to measure the new height the micrometer wheel P is turned so that the plunger is moved outwards sufficiently to restore the liquid to the datum X in the gauge tube; then the movement given to the wheel P is a measure of the movement given to the plunger

B and therefore of the height of water in the tank. This arrangement differs funadmentally from the known hydraulic transmission means in which the pressure in the liquid is measured; ordinary "compo" tubing can be employed, and, as the liquid

N°291,150

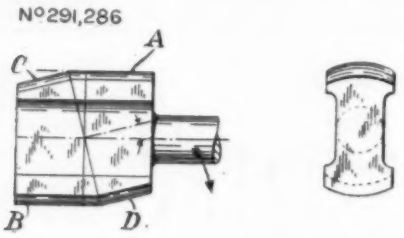


is never under high pressure, errors are not introduced owing to stretching of the tubing. Further, by making the plunger K small and using a fine pitch screw, readings of great delicacy can be obtained. The cock G can be closed in order to drive the plunger B back to zero position if desired.—*May 24th*, 1928.

291,286. November 3rd, 1927.—LIMIT GAUGES, Aktiebolaget Svenska Kullagerfabriken, 17, Artillerigatan, Gothenburg, Sweden.

It is claimed that this gauge facilitates the gauging of holes to maximum and minimum limits. The minimum diameter is determined by the axial cylindrical parts A and B, while the maximum is given by the inclined cylindrical surfaces C and D. The

N°291,286



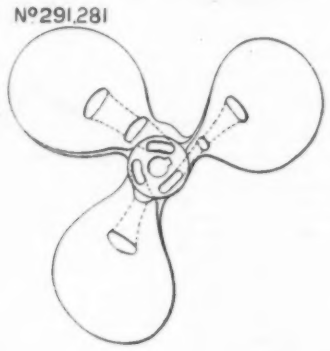
gauge is first inserted axially to test for the minimum diameter, and is then moved to the inclined position. If the maximum diameter is not exceeded the gauge tends to jam, and there will be an audible click as it is restored to the axial position. If the maximum diameter is exceeded there will be no click.—*May 31st*, 1928.

SHIPS AND BOATS.

291,281. October 29th, 1927.—PROPELLERS, W. Lovis, 22, Churston-avenue, Upton Park, Essex.

In this propeller passages are cored out of the boss and the roots of the blade with openings at the rear, as shown in the

N°291,281



drawing. It is claimed that the arrangement reduces cavitation, and that a greater speed is obtained for the same expenditure of power.—*May 31st*, 1928.

MISCELLANEOUS.

277,328. September 6th, 1927.—IMPROVEMENTS IN OR RELATING TO ELECTRIC SWITCHES, *Siemens-Schuckertwerke Aktiengesellschaft, of Berlin-Siemensstadt, Germany.*

For interrupting or breaking electric currents, in particular alternating currents, the parts of the switch have been placed under oil because in this way a large amount of heat is withdrawn from the interrupting arc, which is then more easily extinguished. When it is a question of large switching operations, however, then the arcs can experience very considerable expansions, owing to the fact that they decompose the oil and expand towards all sides owing to the good conduction of the gases of decomposition. The invention relates to a switch in which the volumetric expansion of the arc is reduced to a very small area. The oil, in which the switching operation takes place, has additional de-ionisation substances added to it. These bind the current conducting ions and electrons, which arise in the arc and at the electrodes, in a very rapid manner and thus suppress the arc. As de-ionising substances use is made of the elements of the haloger series, chlorine, bromine and in particular iodine. Phosphorus is also suitable as a de-ionising addition to the switch oil. By choosing the quantity of the substance correctly the arc can be either suppressed immediately on its formation or it may be extinguished somewhat more slowly.—*May 31st*, 1928.

282,758. December 22nd, 1927.—IMPROVEMENTS IN AND RELATING TO ELECTRIC CUT-OUTS, *The British Thomson-Houston Company, of Crown House, Aldwych, London, W.C.2.*

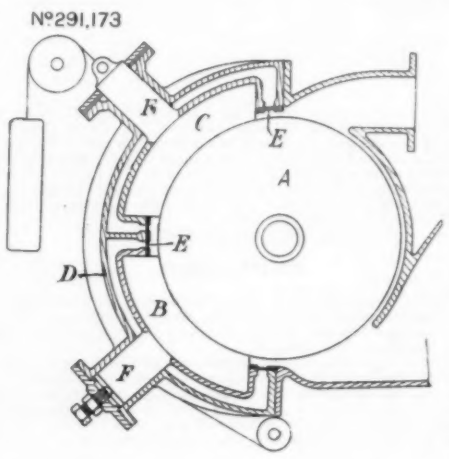
Film cut-outs are employed extensively in connection with series lighting circuits, and the manner in which they are used is well understood by those familiar with such lighting circuits. The film cut-out comprises two plates of thin metal, usually round, between which there is a suitable insulating substance such as thin paper or cloth, the plates and insulating material being united by an insulating adhesive such as shellac. One object of the invention is to provide an improved construction of film cut-out which, while enabling the cut-outs to be manufactured readily, at the same time provides cut-outs having a uniform break-down potential. Another object of the invention is to provide a film cut-out which can be manufactured readily for any desired break-down voltage. A and B indicate the two metal plates of the film cut-out, whilst C is the material which forms the film, and E the adhesive or cement for holding the two plates together. The film material C is arranged at the central portion of plates A and B, and the adhesive E is between the metal plates and around the outer edge of film material C. The adhesive has a higher dielectric strength than has the material C, so that when rupture occurs, it will take place in the film material. Two modifications of the invention are described.—*May 31st*, 1928.

N°282,758

291,173. March 9th, 1927.—BEATING ENGINES, J. White, 53, East Claremont-street, Edinburgh.

This invention is concerned with the beating engines used in paper making, which comprise a beating roll A and knife bed-plate B and C, between which the paper material is macerated. The bed-plates are mounted in a chamber D, to which

N°291,173



they are attached by means of flexible diaphragms E E, and are guided by cylindrical projections F F. The upper bed-plate is counterweighted as shown, and both plates are kept up to their work by hydraulic pressure admitted to the chamber D. The chamber is hinged at the bottom, so that it can be swung clear of the roll for changing the knives.—*May 31st*, 1928.

Forthcoming Engagements.

Secretaries of Institutions, Societies, &c., desirous of having notices of meetings inserted in this column, are requested to note that, in order to make sure of its insertion, the necessary information should reach this office on, or before, the morning of the Wednesday of the week preceding the meetings. In all cases the TIME AND PLACE *at which the meeting is to be held should be clearly stated.*

TO-DAY.

INSTITUTION OF MUNICIPAL AND COUNTY ENGINEERS.—West Midland District meeting. Shire Hall, Shrewsbury. 2 p.m.

INSTITUTION OF SANITARY ENGINEERS.—Holborn Restaurant. Ordinary general meeting. 11.30 a.m.

SATURDAY, JULY 7TH.

INSTITUTE OF BRITISH FOUNDRYMEN: LANCASHIRE BRANCH.—Visit to Messrs. Fletcher, Russell and Co.'s Palatine Works, Warrington. 3 p.m.

TUESDAY, JULY 10TH.

THE INSTITUTION OF ELECTRICAL ENGINEERS: SOUTH MIDLAND CENTRE.—Local summer meeting. Visit to the works of D.P. Battery Company, Ltd., Bakewell, Derbyshire; Haddon Hall; and the Derbyshire and Nottinghamshire Electric Power Company's outdoor sub-station, Ambergate. Assemble Grand Hotel, Birmingham, 8.50 a.m.

THURSDAY, JULY 12TH.

INSTITUTE OF PHYSICS.—The Institution of Electrical Engineers, Savoy-place, W.C 2. "Physics in Photography," by Dr. C. E. Kenneth Mees. 8 p.m.

INSTITUTION OF MUNICIPAL AND COUNTY ENGINEERS.—East Midland District meeting at Glossop. Assemble at the Municipal Buildings at 2 p.m.

FRIDAY, JULY 13TH.

INSTITUTION OF MUNICIPAL AND COUNTY ENGINEERS.—South Wales District visit to Gryne Fawr Reservoir. Assemble Abergavenny Castle, 12.45 p.m.

SATURDAY, JULY 14TH.

KEIGHLEY ASSOCIATION OF ENGINEERS.—Visit to Ferrybridge Power Station, Yorkshire Electric Power Company. Train leaves Keighley 12.5.

SATURDAY, JULY 21ST.

INSTITUTION OF MUNICIPAL AND COUNTY ENGINEERS.—South-Western District meeting at Ilfracombe. Assemble at the Victoria Pavilion at 12 noon.

KEIGHLEY ASSOCIATION OF ENGINEERS.—Visit to Messrs. George Mann and Co.'s works. Train leaves Keighley 1.28.

PERSONAL AND BUSINESS ANNOUNCEMENTS.

RATIONAL CARBONIZATION SYNDICATE, Ltd., and Motor Fuel Proprietary, Ltd., ask us to announce that they have moved their technical and engineering staffs to 13, Victoria-street, Westminster, S.W. 1, but that the share transfer and other business will still be carried on by the Secretary, Mr. G. W. Askew, F.C.I.S., at 14, St. Mary Axe, E.C. 3, the registered office of Motor Fuel Proprietary, Ltd.

SHEFFIELD STEEL PRODUCTS, Ltd., Templeborough Works, Sheffield, asks us to announce that it has acquired the whole of the share capital and assets of the J. L. Morrison Company, Ltd., manufacturers of the Morrison "Perfection" wire stitching machinery used by printers, bookbinders and box manufacturers. The whole of the plant will be removed to Templeborough Works and manufacture will be continued for the future from that address.

EDWARD G. HERBERT, Ltd., asks us to announce that, in view of the fact that Mr. Herbert, wishing to be free to devote more time to research work, has decided to relinquish the position of joint managing director of the company, which he has held since the formation of the company, the following additional directors have been appointed:—Mr. C. Norman Fletcher, Mr. Alexander H. Evans, and Mr. George A. Marriott. Mr. Herbert will act as consulting engineer to the company and as chairman of the board of directors.

THE ASSOCIATED DAIMLER COMPANY, Ltd., announces that it has established sales and service departments in each of its manufacturing establishments, namely, the Associated Equipment Company, Ltd., Southall, and the Daimler Company, Ltd., Coventry. Mr. Norman A. Hardie, general manager of the Associated Daimler Company, Ltd., will represent the Associated Equipment Company, Ltd.; while Mr. L. H. Pomeroy, chief engineer of the Associated Daimler Company, Ltd., will represent the Daimler Company, Ltd.

CONTRACTS.

THE fire protection of the Royal Agricultural Society's Show, to be held at Nottingham, July 10th to 14th, has again been entrusted to Merryweather and Sons, Ltd., of Greenwich.

THE LATONA ENGINEERING COMPANY, Ltd., of Peckham, in association with Messrs. Lebrun of Nimy, have secured the order for refrigerating plant for the Richmond ice skating rink.

BRYSON BROTHERS (Motors), Ltd., 122, St. Vincent-street, Glasgow, has been appointed by the Westinghouse Brake and Saxby Signal Company, Ltd., as its agent and fitting station for Glasgow and the West of Scotland, for Vacuum-Servo and pressure brakes for road vehicles.

THE BROWN-BOVERI ORGANISATION has received an order for a single-shaft turbo-alternator set having an output of 85,000 kW M.C.R. for the Zschornewitz Power Station, Berlin. The most economical output will be 75,000 kW and the speed 1500 r.p.m. The generated pressure will be 13,000 volts and the set is to be designed for a power factor of 0·75.

WORTHINGTON-SIMPSON, Ltd., of Queen's House, Kingsway, London, has received orders for (*a*) two condensing plants, each of 15,000 square feet cooling surface, for the Johannesburg Municipality; (*b*) one surface condensing plant, of 10,000 square feet cooling surface, for the Pretoria electric power station; and (*c*) one surface condensing plant of 12,500 square feet cooling surface, for the East Rand Proprietary Mines. All these condensers are to be complete with steam air ejectors, circulating and extraction pumps, &c.

SIR W. G. ARMSTRONG, WHITWORTH AND CO., Ltd., have received orders for (*a*) a special twin-screw steamer with triple-expansion propelling machinery for the Corporation of Trinity House; (*b*) a 10,300-ton oil tanker with I.C. propelling machinery for John I. Jacobs and Co., Ltd., London; (*c*) an 11,000-ton oil tanker with Diesel propelling machinery for the Aktiebolaget Olson and Wright, of Stockholm; and (*d*) twenty-five superheated locomotive boilers and six boiler shells from the Buenos Aires and Pacific Railway Company.

THE MIRRLEES WATSON COMPANY, Ltd., of Glasgow, has received orders for (*a*) one surface condensing plant of 12,500 kW capacity, for the Scottish Central Electric Power Company, Falkirk; (*b*) one surface condensing plant of 5000 kW capacity, for the Galashiels and District Electric Supply Company, Ltd.; (*c*) one Mirrlees-Delas-Ginabat surface condensing plant of 2000 kW capacity, for the Gondalpara Jute Mills, India; (*d*) a 10in. pump of its "Chokeless" design for dealing with unscreened sewage, for Southend-on-Sea Corporation Sewage Department; and (*e*) two bore-hole pumps and two booster pumps, for the Ashby-de-la-Zouch Corporation.

WHITWORTH SOCIETY.—The fifth summer meeting of the Whitworth Society was held on Thursday, June 28th, during the summer meeting of the Institution of Mechanical Engineers at Southampton. The dinner took place at the Dolphin Hotel, the chair being taken by the President, Mr. Thos. Sugden, who installed the new President, Mr. F. H. Livens, of Lincoln. An interesting discussion took place regarding "The Whitworth Book." The membership roll now comprises more than 500 names. Full particulars of the Society may be obtained from the Hon. Secretary, care of Institution of Mechanical Engineers, Storey's-gate, Westminster, S.W. 1.

PEDLER RESEARCH SCHOLARSHIP.—The Council of the Institute of Chemistry has decided to utilise the income from the legacy bequeathed to the Institute by the late Sir Alexander Pedler for the provision of a scholarship to be known as the Pedler Scholarship. The scholarship will be of the value of £250 per annum and will be open to Fellows and Associates of the Institute. The scholar will be required to undertake work on a problem or problems to be chosen by the Council. In selecting the problem the Council will have regard to the need for its investigation in the public interest. The Council invites Fellows and Associates to suggest suitable problems for investigation under this scheme, and will be glad to receive such suggestions before Tuesday, July 10th. The Pedler Fund Committee will then announce the problem and will invite applications from candidates for the scholarship. The selected candidate will be informed of his or her appointment before October 1st, with a view to commencing work as soon as possible after that date.